THE ELECTRICAL WORLD
A Weekly Review of Current Progress in Electricity and its Practical Applications

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W. J. JOHNSTON, Editor and Publisher.
T. COMMERFORD MARTIN, JOSEPH WETZLER. Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.
Western Office, 44 Lakeside Building, Chicago.
W. A. KREIDLER, Manager.

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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. VIII. NEW YORK, DEC. 11, 1886. No. 24.

WINTER lays its cold, obstructive hand on subway operations, but apparently nothing interferes with the upripping of the streets for steam-pipe extensions and repairs.

ACCORDING to papers in the northern part of the State, Niagara is again proposed as a power plant for running electric lights "supplying the whole of Western New York." By all means!

A NUMBER of excellent points are made in an article in this issue relative to the work of the "electric light fitter," on whose skill the success of lighting installations so much depends. The day of rule-of-thumb methods has gone by. The practice must be intelligent and scientific or it carries failure with it.

IT strikes the sender of a cable message that three days for transmission from New York to London is a little too long. The allegation that the address of the recipient was indistinct is hardly an adequate excuse for delay. In such a case, the sender ought certainly to be advised. But, as the complainant puts it, can you expect first-class service at such low rates?

THE fact that an accumulator of American make is being put on the market by a strong organization that includes some of the most prominent men in electrical circles, is one of more than usual importance. It will be noted that the battery, of which we give an illustration and description in another column, is guaranteed for a life of two years and a return of 80 per cent. of its charge. Is the long winter of adversity of the accumulator at an end?

WE publish this week the results obtained in the operation of the Julien car at Hamburg. They are of interest as showing the actual expenditure of coal required to drive a car. From the figures given, it appears that an energy of 1.2 horse-power per hour is sufficient to propel a car one mile. Reducing this to actual coal consumption in a good engine plant, it is equivalent to the consumption of 3½ lbs. of coal per car mile even with accumulators. This ought to be cheap enough for any reasonable man.

WE give some account in this issue of the Scranton electric railway that went into operation last week, using the Van Depoele system. A very noticeable feature is that the generating plant is placed in the electric light station. The electric light men have a "privilege" on this new business, and many will probably be availing themselves of it in a short time. The care of an additional dynamo, or half-a-dozen, means little to a station running lights.

AS instancing the progress in the introduction of the method of telegraphing to and from trains, it is of interest to note that the line on 58 miles of the Lehigh Valley Railroad, equipped on the Phelps system, is now in successful operation. A dispatch received by us this week from the officers on their tour of inspection, was sent while the train was running at the rate of fifty miles an hour. Railroads are proverbially conservative, and the employment of the system is, therefore, a significant admission of its value.

THE difficulty of keeping absolute electrical instruments constant in their indications even when situated beyond the reach of great disturbing influences is well known, and such instruments require frequent calibration to insure their reliability. When placed in electric light stations under the influence of powerful dynamos constantly changing in their magnetic strength, it is evident that the calibration must be almost a continuous one, as in incandescent lighting it is essential to economical working to maintain the potential at certain fixed points. It is interesting to note, therefore, that a method devised by Mr. John W. Howell reduces the labor required for the purpose of calibration by reducing the number of absolute instruments necessary in such situations.

MANY new features are coming up daily in connection with the underground work, but it has been reserved for Boston to present a special difficulty to notice. One of the papers there says: "It was developed at the hearings before the committee in the spring that the two systems (telephone and electric lighting) could not be laid in the same trench close together because the vastly greater power of the telephone current would cause *static reduction* or a disturbance and disarrangement of the weaker current." If this be the case, we do not see how the lighting circuits manage to struggle along. Perhaps the reason why the telephone current is so ferocious and powerful is that Boston is the chosen home of the Bell "monopoly" and that it regards the lighting current as an intruder to be snubbed.

ONCE more the cry is raised that the judges who have rendered decisions supporting the Bell patents have been corrupt. The charges are directed against Judges Gray and Lowell, who, at the time they pronounced in favor of Bell, had several relatives who were holders of Bell stock. It does not appear, however, that they were aware of this fact, and the New York *Herald* itself, after giving prominence to the matter in its columns, says: "We do not impute to either Judge Gray or Judge Lowell a knowledge of the wrongful position in which they were placed, nor do we charge either with improper conduct." That seems to us equivalent to an exoneration. It would perhaps be difficult to find any family of wealth and distinction in Massachusetts, some members of which have not been Bell stockholders. At the same time, it is well to have this jealousy regarding the integrity of our judges and this insistence on their impartialty.

IN the course of a recent article in our columns, Mr. I. L Roberts suggested that the intense avidity of carbon for oxygen exhibited in their chemical combination, called combustion, would be a powerful source of electricity if we could only attach binding posts to these elements. Such a method seems to be that described in another column in which the combustion of hydrogen and oxygen constitutes the source of electric current. While heat is employed externally in the battery of Mr. Kendall, its application is only a means to an end, and is for the purpose of maintaining the electrodes in a condition such that they will allow the passage of hydrogen gas through them. Hence it is evident that the heat of combustion of the gases can be employed for this purpose and the apparatus to a considerable extent made regenerative in its action. While it is claimed that currents of considerable power can be obtained in the manner described, no figures are given by which the efficiency of the apparatus and the cost of the current produced can be ascertained.

PROFESSOR SNYDER, in his lecture before the Franklin Institute, quoted elsewhere, draws a series of excellent inferences on the relation of pure research to the late Philadelphia Electrical Exhibition. He shows, truly, that we who have benefited so much from the labors and research of other nations owe it to our own reputation to provide adequate means for pursuing scientific work for science's sake alone. He instances the great Royal Institution of London, to show what can be accomplished by a liberal endowment which permits the scientist to experiment freely, entirely independent of the results obtained. He calls upon our public-spirited citizens to provide the means for founding such an institution, but it is only too true that they, as a rule, are averse to lending aid to a project which does not yield immediate results. Still the subject ought to be agitated, and, as we pointed out some time since, the government ought to be enlisted in such an enterprise, which would be of lasting benefit to the whole country.

THE electric light is steadily gaining ground in England. The people of Liverpool are now—it is about time—beginning to wonder why their streets cannot be lit and made safe by arc lamps, when so many other towns of much smaller proportions rejoice in the sunshine of electricity. In Birmingham there is a hopeful revival of plans for incandescent lighting. At Bradford the electric light has won a very high opinion for itself in disinterested quarters, and at Tavistock a proposition has been made for lighting the town. Meantime the isolated installations, always the strong point of our English friends, multiply apace, and now that capital is showing itself ready for venture, there is no reason why a large proportion of it should not be placed in the sound investments that can be found in the electric lighting field. Our English contemporaries will no longer have to be impatient at the absence of enterprise in the department of electrical application. The times have changed somewhat in England, and we think that under the new conditions even American electric light men might find abundant occupation there, if they were not so busy here.

THE very interesting paper by Mr. Gisbert Kapp, "On the Determination of the Characteristics of Dynamos," which is continued in this week's issue, brings out a very important point in the loss encountered in dynamos by the leakage of magnetic lines of force through the air across the pole pieces. Mr. Kapp shows that, while with small magnetizing powers the leakage of lines is small as compared with the number passing through the armature, on account of the high magnetic resistance of the air, this proportion is entirely changed when the magnetizing powers increase. The result is, as stated by Mr. Kapp, that the number of lines created must be sensibly greater than the number utilized, which necessitates making the area of the magnet core considerably larger than that of the armature core. This evidence of the strong influence exerted by lines of force conducted through the air recalls forcibly the experiments made by M. Deprez, given in our last issue, in which he showed that the law of inverse squares does not hold true for the force of magnetism; in other words, he, like Mr. Kapp, showed that the magnetic conductivity of air is far greater than had heretofore been supposed. The results of M. Deprez and Mr. Kapp thus coincide to a remarkable degree, though arrived at in two entirely different ways, and seem to point directly to the correctness of M. Deprez's announcement. Considering further, however, the result obtained by Mr. Kapp, viz., that the area of the magnet core should be considerably larger than that of the armature core, it would seem that the experiments were carried on with machines in which the pole pieces encircled the armature to a considerable extent, and approached each other within comparatively close proximity. We are led to this belief from the results obtained by M. Gravier, of Paris, which were detailed in our columns some time since. It will be remembered that the rules laid down by him were, that the area of the cross-section of the armature should be equal to that of the field magnets, and that the pole pieces should not encircle the armature more than 90 degrees each. It will readily be seen that this construction keeps the pole pieces apart to such a degree as to reduce the leakage through the air, and thus, it would seem, obviates the necessity of increasing the area of the magnets in order to allow for the leakage which would ensue where they are brought into close proximity. It is true that M. Gravier's construction increases the dimensions of the machine, but the results obtained by him attract attention in this connection. It should be remarked, however, that they were carried out with the Gramme ring type of dynamo.

On the Predetermination of the Characteristics of Dynamos.*

BY GISBERT KAPP.

(*Continued.*)

Before entering into the question of how this part of the curve can be obtained, it will perhaps be best to illustrate by analogy to the voltaic circuit the conception on which the formulæ to be given are based. Let in Fig. 1, R_a represent a certain resistance (corresponding to the magnetic resistance of the armature core), connected by resistances $\frac{R_\alpha}{2}$ (representing the two air spaces) with the poles (p p) of a voltaic battery having a resistance R_f (corresponding to the field-magnet) and an internal electromotive force P (exciting power).

Imagine at the first the apparatus well insulated, then the current z_1 is given by the ratio of P and the sum $(R\alpha + R_a + R_f)$.

If now the battery be submerged into a badly-conducting medium, currents will flow as shown by the dotted lines, and consequently through certain cells a current flows which is larger than the useful current in R_a. It is impossible to say exactly in what manner these currents of leakage are distributed, but it is evident that the most serious loss must occur between the poles where the difference of potential is a maximum, and that in a given medium and arrangement of battery the total loss through leakage can be considered as approximately proportional to the difference of potential between the poles. Let the latter have

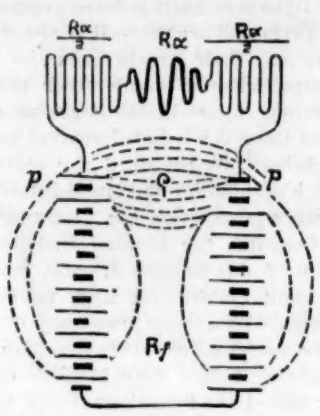


Fig. 1.

the value p_1, then the current lost ς, equals p_1 / ρ, if by ρ we represent the average resistance of the surrounding medium for this particular configuration of battery. We can also, with fair approximation, put the current in the battery—

$$z_2 = z_1 + \varsigma.$$

Now imagine that by some means we can give to the electromotive force (P) of the battery any value between zero and that value which will produce the maximum current (z_1) required. It will then be possible to determine what electromotive force is required for each value of z_1 between zero and maximum. To do this we proceed as follows: We determine first the differnce of potential at the poles—

$$p_1 = (R_\alpha + R_a)\, z_1 \qquad (1)$$

then the loss by leakage—

$$\varsigma = \frac{p_1}{\rho} \qquad (2)$$

then the total current—

$$z_2 = z_1 + \varsigma \qquad (3)$$

then the loss of electromotive force (p_2) occasioned by the internal resistance of the battery—

$$p^2 = R_f z_2 \qquad (4)$$

and, finally, the total E.M.F.—

$$P = p_1 + p_2 \qquad (5)$$

The submerged battery is analogous to a horseshoe magnet, since the latter is always surrounded by a medium which allows the passage of magnetic lines. To the electromotive force of the battery corresponds the total exciting power applied to the magnet; to the currents z_2, z_1, and ς correspond numbers of lines respectively created within the magnet core, passing through the armature, and lost by leakage; the analogy of resistances has already been mentioned.

Since for small degrees of magnetization the resistances of armature and magnet are not very different from their lowest initial values, which are very small in comparison with the resistance of leakage, it follows that for the early stages of magnetization leakage has very little influence on the exciting power; in other words, that the creation of leakage or waste field does not materially increase the expenditure of energy required to produce the useful field. For a more intense magnetization, such as found in the usual working conditions of dynamos, the case is, however, very different. In the first place, the resistance of the armature has now considerably increased, and with it has increased at a still faster ratio p_1, that portion of the exciting power (or magnetic pressure at the field-poles, if I may be allowed to use a somewhat unscientific term) which is necessary to force the lines through air space and armature. The immediate result is a large increase of the waste field, which has to be provided for by the magnet; augmenting, therefore, the density of lines in the case of the latter considerably beyond the value which would otherwise correspond to the useful field. Hence large increase of magnetic resistance, and consequently also of exciting power. This fact—that the number of lines created must be sensibly greater than the number utilized—explains at once the necessity of making the area of the magnet core considerably larger than that of the armature core. If, with a view to get an equal density of useful lines in armature and field, and thus save weight, the cross section of the magnet be reduced to that of the armature, it will be found absolutely impossible to saturate the latter, no matter how much exciting power we put on. A machine so constructed would therefore be a failure, not only on account of lower voltage, but also because it could not be compounded. Dynamo makers have long ago found out by practical experience that to produce machines of high voltage as compared to the length of wire on the armature, and machines that by reason of their rising characteristics can satisfactorily be compounded, it is necessary to work with a high magnetic density in the armature and a low density in the field. Roughly speaking, if we only take the useful lines into consideration, the ratio is from 1 to .5, to 1 to .6.

Before the formulæ (1 to 5) can be used for the actual determination of total exciting power as a function of the number of useful lines in any given dynamo, it is necessary to make an assumption regarding the rise of magnetic resistance with increasing density of lines. Whatever may be the mathematical connection between these two quantities, it must be of such a nature that for low densities the rise of resistance is insignificant; whilst for a certain and definite maximum density, the exact value of which depends on the nature of the iron, this rise is infinity. Among the formulæ which might be devised to fulfill these conditions two fairly simple expressions naturally suggest themselves—the one where the increase of resistance is made proportional to the reciprocal of the difference between saturation density and working density, and the other where it is made proportional to the tangent of an arc which represents the degree of saturation to such a measure that 90 degrees corresponds to absolute saturation. The value of either of these two assumptions, or of any otner which might be suggested, cannot be argued out on theoretical considerations, as we know as yet too little of the laws of electro-magnets. The only way is to apply either theory to machines actually tested, and then see which fits in best with practical results. In this way I have found the tangent formula to give better results than the other, and to fit actual experiments with sufficient accuracy for practical work. Without pretending to give a scientific reason why this formula should be better than any other, it might be pointed out as at least plausible that a tangent function might enter into the relation between exciting power and magnetization. If we assume the act of magnetization to consist in the bringing of molecular magnets into approximate parallelism with the lines of force pass-

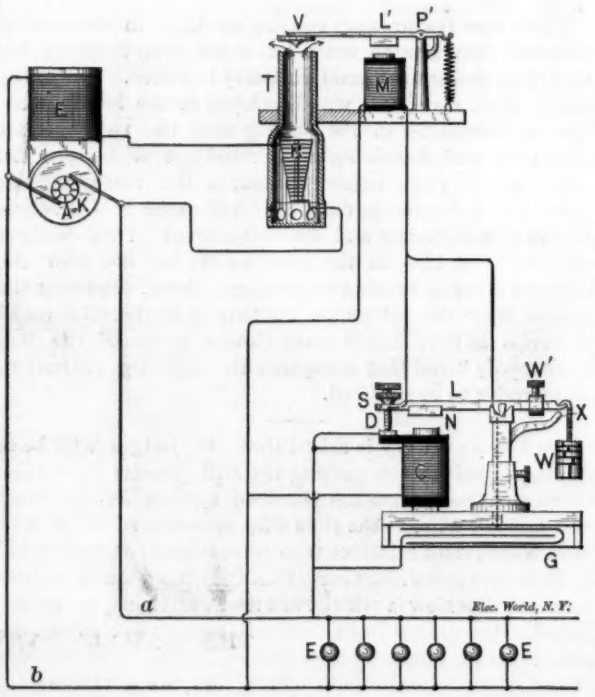


Fig. 1.—Thomson's Method of Dynamo Regulation.

ing through the metal, while the force resisting magnetization—which might be a passive one of molecular friction or an active one of inter-molecular attraction or repulsion—tends to turn the molecular magnets away from that position, we can consider each molecular magnet as the needle of a tangent galvanometer having a field of its own and a zero position which may possibly be different from that of its neighbors. Whatever the configuration of these molecular magnets may be, it is at least conceivable that the average angle through which they have been rotated is equal to that of a molecule which started from a position at right angles to the direction of the magnetising force, and that, therefore, the tangent of this angle is a measure for the current, or, rather, for the exciting power surrounding the core. The weak point of this theory is that it does not show why the angle of rotation should be proportional to the number of lines created, and therefore I do not put it forward as a true, but simply as a possible, explanation.

(TO BE CONTINUED.)

* A paper read before the Society of Telegraph Engineers and Electricians.

A Novel Regulator for Dynamo-Electric Machines.

It is usually considered wise to prevent as much as possible the heating of circuits and regulating apparatus employed in electric lighting, but this very heating effect has recently been employed by Prof. Elihu Thomson to effect the regulation of dynamos.

It is well known that with metals generally the electrical resistance increases with an increase in temperature, and this is the property which is employed by Prof. Thomson to obtain a gradual regulation of the current, or more particularly to maintain a constant electromotive force on shunt-wound and compound incandescent machines.

Before entering into the details of the apparatus employed, it may be well to premise that there are four distinct parts which come into operation to effect the desired regulation; these consist of, first, a "controller" magnet connected to the circuit so as to be sensitive to changes in its electrical condition; second, a "motor" device which is governed in its action by the controller magnet; third, a variable resistance connected to the dynamo in such a way as to control the generating capacity of the same, and composed of a material whose resistance varies with the changes of temperature; and, fourth, apparatus for governing the temperature of the resistance coil.

The accompanying illustration, Fig. 1, shows the manner in which the above conditions are carried out. As will be seen, the field coils are placed in shunt to the work, and in the shunt is included the resistance R. composed of platinum or iron, and forming a considerable fraction of the total resistance of the shunt. The resistance R is enclosed in a tube, or chimney, lined with a

Fig. 2.

non-conductor of heat, and having holes at the bottom for the entrance of air.

The opening at the top of the chimney is controlled by a valve V at the end of the lever L' carrying the armature of the magnet M. The valve controls the draft of air through the chimney T, produced by the heat developed in the coil R, and, according to the draft, determines the temperature that the coil shall attain by the agency of the heating effects of current passing through it.

The magnet M is energized from the mains a b, and its circuit is controlled by contacts operated by the controller magnet C. The controller contacts consist of a stop D and a contact screw S, made adjustable and mounted on the lever L, which carries the armature N of the electro magnet C. The contact D is connected to one of the mains a, and the contact S is connected through the electro magnet M with the other main b. In addition, there is a condenser G, for preventing spark at the contact D on the opening of the circuit of the magnet. The electro magnet C is also connected in one of the branches, between the mains a b, so that it will feel any changes in the conditions of potential between the mains a b.

The armature lever L is mounted on knife-edge bearings, and the pull of the magnet is counterbalanced by a variable weight W, which is hung so as to avoid friction on the bearings of the lever, and which is preferable to a retractile spring on account of its constancy. A rider-weight W' is also provided, which can be moved to effect small adjustments of counterpoise.

Assuming an adjustment to be made so that there will be a balance when the electro-magnet C is energized to normal amount, and that the screw S is set so as to act in conjunction with the back stop X of the lever to permit a small play at the controller contacts, it will be evident that any very slight variation in the difference of potential between the mains a b will cause an increase or decrease of power of the magnet C, which will be attended by a closing or opening of the contact at D. By the action of the controller contacts D S, the magnet M is thrown into or out of action, and from this there results a change in resistance through a closing or opening of the valve V, with a consequent heating or cooling of the resistance R as the cooling draft of air is cut off or re-established by the operation of the valve.

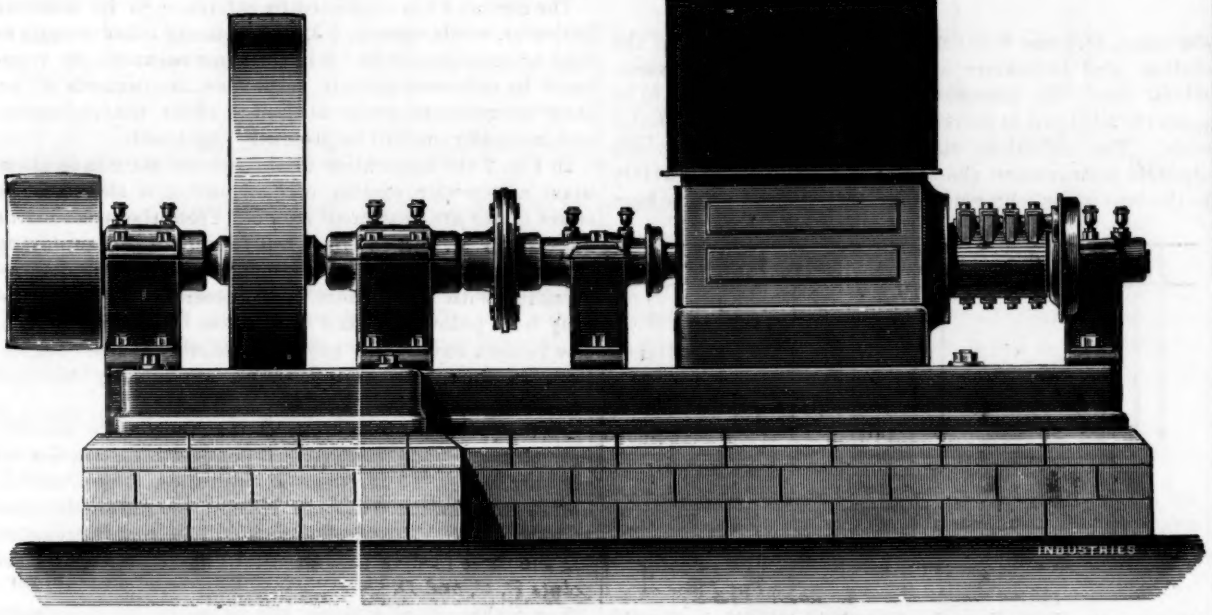
An increase in the temperature of the resistance R, produced by closing the valve, results in introducing greater resistance to the flow of current in the field circuit, including coils F, and therefore diminishes the power of the field magnet of the machine, while conversely the lowering of the temperature of R through the establishment of the cooling air draft results in greater power of the field magnet. These changes in the field magnet change the generating capacity of the machine and the difference of potential between the two mains a b. In practice, there is a vibration of the parts, resulting in the maintaining of

such a temperature in the coil *R*, through vibration of the valve as to secure a constant electromotive force, or constant difference of potential between the mains *a b*.

While employment is made of platinum or iron coils as the medium of action, it is obvious that carbon resistances could also be used, but in this case the action of the valve *V* would have to be reversed since carbon *decreases* in resistances with an increase of temperature. The resistance *R*, which is shown in Fig. 2, is mounted on a tapering frame so that its successive turns will be displayed laterally and will not shield one another from the current. The frame is constructed of tapering wings, formed of a non-conductor—such as mica—and supported at their inner edges in a metal or plaster stem. At the outer edges of the wings suitable notches are cut for the reception of the iron or platinum wire making up the coil.

New English Dynamo.

The accompanying engravings, taken from *Industries*, represent a side elevation and plan of a recent form of dynamo made by Messrs. Elwell & Parker. The field



THE ELWELL-PARKER DYNAMO—SIDE ELEVATION.

magnets in the vertical arrangements are similar in type to those used in the modern Edison-Hopkinson dynamo; that is to say, the pole ends of the magnet are placed on a non-magnetic base, and the limbs, as well as the top yoke, are made of soft wrought iron, specially annealed. Only two exciting coils are used, one on each limb. The somewhat unusual appearance of this dynamo is due to the fact that it is intended for use with a gas engine, and a very heavy fly-wheel has been provided to steady the motion, the armature and a short piece of shaft, with fly-wheel and driving pulley, being supported on one cast-iron bed. The mechanical portion of this arrangement is made to the design of Mr. Henry Lea, of Birmingham, whilst the electrical portion is according to the usual practice of the firm.

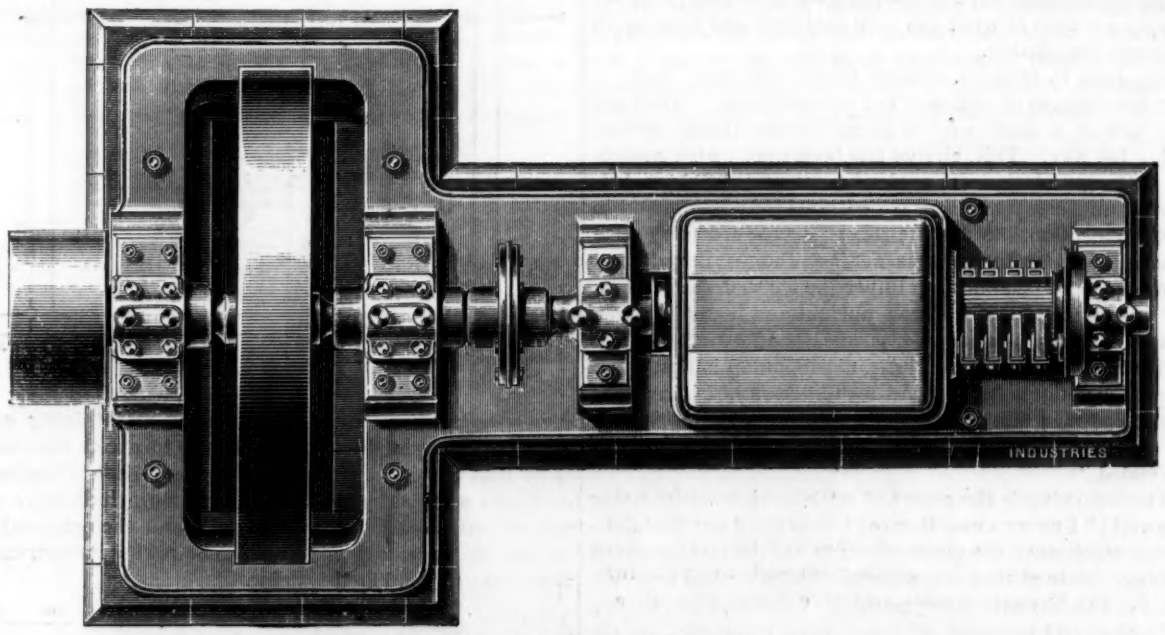
The Scranton Electric Railway.

The electric railway, at Scranton, Pa., which has recently been equipped with electrical apparatus by the Van Depoele Electric Manufacturing Company, of Chicago, is owned by the Scranton Suburban Railway Company. The principal stockholders are Messrs. Thos. Dickson, George Sanderson, E. B. Sturgess, J. W. Garney, O. S Johnson, T. F. Torry, A. L. Spencer, C. P. Breck, trustee; J. Ben. Dimmick and Wm. Hanly, of Scranton; and Samuel Robb and others, of Philadelphia. Mr. E. B. Sturgess is president, Thos. F. Torry, treasurer, and Geo. Sanderson, secretary. Before adopting the Van Depoele system a committee visited all the electric railways in operation or in the experimental stage in America, and Mr. Sturgess visited Europe and personally examined all the electric railways there.

The road at present constructed and equipped is two and a quarter miles long, commencing on Franklin street at the corner of Lackawanna avenue, opposite the Delaware, Lackawanna & Western Depot, running to Spruce street, up Spruce street, past the new court-house to Adams avenue, thence on Adams avenue to Ash street, then making several turns to the right and left, running some distance on Green Ridge street and Adams street, to the present terminus, which is in a delightful residential part of the city. The track for the greater portion of the distance is of heavy Johnston steel street rails, and the remainder 45-pound T rail; it is standard guage, four feet eight and a half inches. Scarcely any level track can be found in the whole line; there are twelve grades, most of which are over six per cent., besides six right angle curves, mostly of 45-foot radius, with some of the heavy grades on the curves.

There are at present only two cars running. They were built by the Pullman Palace Car Company, at Pullman, Ill., and are 16 feet long, with the front platform inclosed. They are painted the same color as Pullman sleepers, and are finished in mahogany. They are lighted by central oil lamp and by incandescent electric lamps, taking the current from the main conductor, and present a beautiful appearance. The current is generated by a 60 h. p. Van Depoele generator, at present stationed at the electric light station and run from its countershaft. An overhead conductor is used consisting of a bare copper wire $\frac{3}{10}$ inch in diameter directly over the track, the rails being used for the return circuit. The conductor is suspended on wires which cross the streets and are attached to poles on each side thereof. A traveler with rollers passes over the conductor and rolls along on it, and a cable conveys the current from the traveler to the motor on the car. The motor is located on the front platform, where it is in constant sight of the driver, who handles the crank turning the current on or off, and regulating the speed of the motor. The speed of the cars is from four to fifteen miles per hour. The cars at present leave each end of the road every fifteen minutes.

The weight of the cars with the motors is 9,000 pounds. The motors are 15 h. p. each and weigh 2,000 pounds. The cars start gently without that sudden jerking motion which is incident to horse cars. The motors are geared to a countershaft, and the countershaft is connected to the front axle of the car with a chain made for this special



THE ELWELL-PARKER DYNAMO—PLAN.

purpose. The street railway company pays the electric light company $9 per day for power, commencing at 7 A. M. and running until 12 o'clock at night. It is intended to extend the road and increase the number of cars in the spring. The road was started when about a foot of snow and ice was upon the track. To add to the difficulties, no snow plow had been provided, and the track in the business part of the city is several inches lower than the pavement surface, on account of a change in grade in the streets, the track being laid to correspond to the new paving to be put down in the spring, which will be that much lower than the old grade of the cars. Everything has worked splendidly, and the officers of the railway company are highly pleased with its success. The local *Free Press* of Dec. 5 says:

The success of the electric street railway has solved the problem of rapid transit for Scranton, and furnished an easy and cheap communication between the city and the suburbs. There is absolutely nothing to prevent the extension of the Suburban railway from its present terminus at Forest Hill Cemetery, on the one side to Dunmore and on the other side to Providence, and the saving of time, as well as the uniform five cent fare, will bring the road great popularity. The great complaint against the other street railway lines is their slowness. People residing in Dunmore or Providence and doing business in the city have been obliged to waste one and a half to two hours every day in going to and coming from their places of business. If this waste can be reduced even by one-half it will be a great boon to suburban residents.

The extension of the electric road to Dunmore and Providence will force the People's Street Railway Company to adopt the electric plan under the penalty of losing all their through passengers. If they continue to use horses, they must depend for patronage almost entirely upon the people who live along the line of their track. We are not prepared to believe that the People's Street Railway Company will be willing to allow to pass over to its competitors the business which it has been building up for many years when the means are at its hands to retain that business. We therefore look forward with confidence to the adoption of electricity as a motor on all the street railway lines of this city. It has been proven practicable, and he who stands in the way of progress will be apt to come to grief under its wheels.

Bell Telephone and the Bench.

Few patents have ever been so strongly fortified by decisions in the courts as those upon which the Bell Telephone Company is based. As was pointed out by Mr. C. N. Fay at the St. Louis telephone convention last September, "In America, two judges of the Supreme Court, five judges of the Circuit and seven judges of the District Courts of the United States, in thirteen stubbornly contested cases, conducted by the first lawyers of the land, in eight different States have for ten years steadily pronounced in Bell's favor." From time to time the cry has been raised that the judges have been "bought," but so far no specific charge of corruption has been laid at any judicial door. Last week the New York *Herald* published, however, under a Washington date line, a long and even bitter article, the object of which was to show that some of the relatives of Judges Gray and Lowell had been holders of Bell telephone stock, and that therefore the judges might have been influenced in their decisions supporting the patent. The article does not make any direct attack, but proceeds by way of innuendo. The gist of the matter is as follows:

The Spencer suit was brought in the United States Circuit Court held by Judge Lowell in Boston. It was argued June 14, 1881. The decision was rendered by Judge Lowell on June 27, just twelve days after the argument. It was favorable to the Bell Company. It now appears that at that time Judge Lowell's father held thirteen hundred shares of Bell stock as collateral. The loans had been obtained from him by the largest brokers and speculators in the stock and the largest holders of it. One of them had been, if he was not then, a director in the company. At that time also Judge Lowell's brother held as his own three hundred shares of the stock, while a smaller amount was owned by the judge's nephew. When the decision was announced the stock jumped from a hundred and forty-six to a hundred and fifty-four, and in three days it went up to a hundred and seventy.

The next suit brought is known as the Dolbear case. It was argued before Judge Gray and Judge Lowell in May, 1882. It was decided in January, 1883, in favor of the Bell Company. The opinion was written by Judge Gray and concurred in by Judge Lowell. From returns made in March, 1882, while the Dolbear case was pending, and only two months before it was argued, it appears that numerous "relatives" both of Judge Gray and Judge Lowell

were large holders of Bell stock. Judge Lowell's brother held thirteen hundred shares as collateral and three hundred of his own, while thirty shares were owned by one nephew and fifteen by another. Not fewer than seventeen relatives and connections of Judge Gray were, according to the returns, in possession of the stock, including two brothers, two sisters and ten cousins. The number of shares held by them all aggregated seventeen hundred and forty-eight.

On the morning of the day—January 23, 1883—on which Judges Gray and Lowell announced the decision in favor of the Bell Company in the Dolbear case, Bell telephone stock was quoted at 200. On the evening of that day it was 228. Soon afterward it reached 290. In March, 1882, 345 shares were owned by the brother and two relatives of Judge Lowell, and 1,748 shares were standing in the names of Judge Gray's relatives and connections. The shares were then rated at about 130. After the decision given by Judges Gray and Lowell in the Dolbear case, in January, 1883, these shares had more than doubled in market value. If it be assumed that they were still held by the same relatives, the enormous gains that flowed to them in consequence of the decision are apparent.

This is the substance of the article as well as of its implications and hints, but the *Herald* adds: "We do not impute to either Judge Gray or Judge Lowell a knowledge of the wrongful position in which they were placed, nor do we charge either with improper conduct," but it believes that, "assuming that the judges were ignorant of these matters, they were the innocent victims and unconscious instruments of a scheme to use the judiciary in the interest of the Bell telephone monopoly—a monopoly that now stands charged by the government with having obtained its patent by fraud."

Judge Gray has taken no notice of the matter. Judge Lowell has freely expressed his indignation at the attack on his character and the reputation of his family.

Mr. Russell Gray, one of the brothers of the judge, says: "I do not think there is anything I can say in the matter. As far as attempting a defense of the judges is concerned, that is entirely unnecessary, as they can stand safely upon their well-known character and reputation, and I do not believe they would care to have anything said in their behalf. As far as relations of mine holding stock of the company is concerned, that is true, although there are a number who appear in the *Herald's* list who are not relations. I hold Bell telephone stock and presume I did at that time, but it was bought in open market as an investment, and I did not get in on the ground floor through any underhanded information. I have never had any conversation with the judge regarding my investment in Bell telephone."

Mr. William R. Driver, the treasurer of the American Bell Telephone Company, says:

"I don't think there is any need of any reply to the *Herald* article. The judges are too well known as men of unimpeachable character to need any defense, and as far as the charges against the company are concerned, they are simply a rehash of what has been said time and time again without foundation."

Mr. John E. Hudson, counsel for the company, says:

"The charges of collusion are all moonshine. They are the talk of a man who is angry because things are not going his way. This charge has been urged with equally as little foundation in various cases. The charges, it is almost unnecessary to say, are without foundation, and in this connection the New Orleans decision is very good reading. As for the charges against Judges Lowell and Gray it would be almost an impertinence to defend them, so well known are they as upright and honorable men whom such a ridiculous charge will not affect at all. It is sometimes an insult, you know, to call a man honest when the fact is established beyond argument, and I know that neither Judge Gray nor Judge Lowell would notice such an attack as this, and believe they would not care to be defended."

The following is the report of an interview with Judge Lowell: "I never knew that my brother had any Bell Telephone stock until the present year, when the fact came out through some chance conversation which we had concerning the Pan-Electric investigation. Of course, had I known that he or any relatives of mine were interested in the stock, I should have been most glad to decline hearing the case. I received my salary, of course, and should be glad to be relieved of that or any other case. As for myself, I never had anything to do with the stock, never held a share and know little about this Bell telephone matter, anyway, except that I am master in the controversy between the Bell company and the Western Union. I have never seen the evidence in the great Pan-Electric case and only know of it as I have from time to time seen it discussed in the newspapers. I have always said—and I adhere to the statement—that there is nothing wrong in the course adopted by Mr. Garland. He simply turned the case over to the solicitor general, as I might, in this case of mine, have turned it over to Judge Nelson, and as I should have done had I supposed my relatives were interested in the Bell stock. Now as to Judge Gray. I see by the published statement that all his relatives—two brothers and two sisters—were holders of Bell stock. As he is himself on the bench at the present time, perhaps he would not care to say a word about the matter. But I will say this: I have no doubt but that he is in exactly the same predicament as myself, and that he was in ignorance of stock being held in his family. In regard to this long list of supposed relatives holding stock, I will say that some of them are not relatives at all, and in other cases the relationship is very remote."

Howell's Method of Indicating the Potential of Incandescent Circuits

In order to insure long life of lamps, and to secure uniformity in the installation of distributing systems, it is considered essential to maintain the same potential at different points in the systems, these points being usually the ends of the feeders, where they join the distributing mains. In order to keep the potential or "pressure" at these points

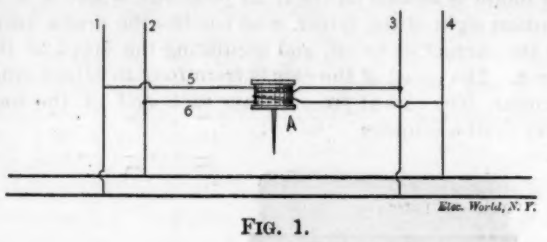


Fig. 1.

the same, pressure wires are run back from them to the station, and indicators are connected with these wires, which show the potential and enable the feeders to be properly adjusted to correct the pressure at their outer ends. The indicators usually employed, thus far, are absolute instruments; that is, each is connected directly to the two wires whose difference of potential is to be kept

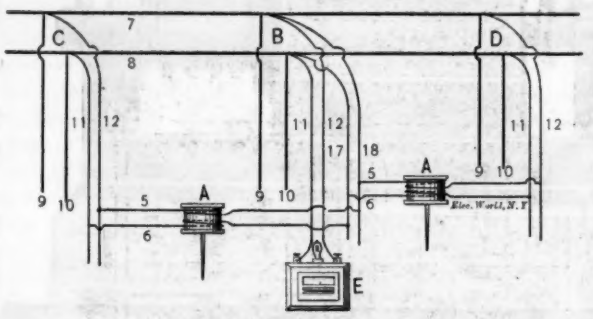


Fig. 2.

constant, the E. M. F. of the lines being applied directly to the indicator, which thus shows directly the pressure at that point. With this method an absolute measure of the pressure at each of these points is had, and each of the indicators must be kept in accurate adjustment independent of all the others. Experience has shown that these indicators are liable to get out of adjustment, and hence to

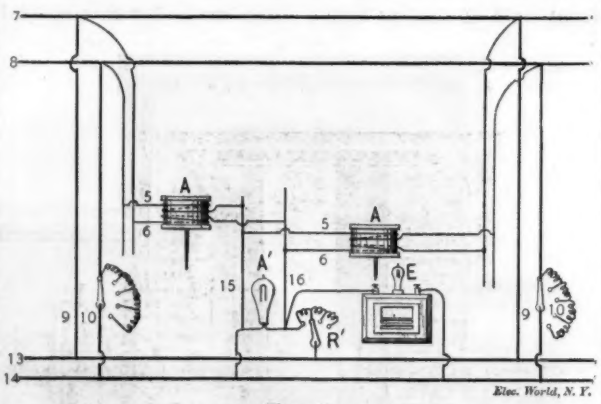


Fig. 3.

give wrong indications, resulting in the maintaining of a wrong pressure at the feeders. It was to avoid this difficulty that Mr. John W. Howell, of the Edison Company, devised a method by which these absolute indicators are used at one point in the system only, and the potential at all the other points is measured by comparing it electrically with the potential at this point.

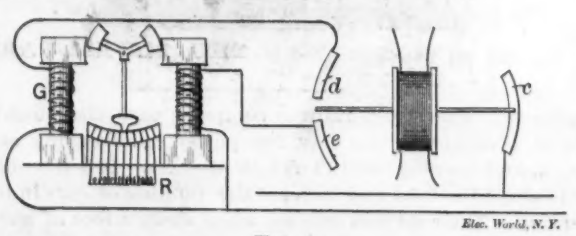


Fig. 4.

The principle involved in this method is shown diagrammatically in Fig. 1. Let it be assumed, for instance, that it is desired to maintain the same difference of potential in the circuits 1 2 and 3 4, and that 1 2 is provided with an absolute indicator which shows the difference of potential between 1 and 2.

In order to show whether or not the pressure at 3 4 is the same as at 1 2, Mr. Howell produces an electrical comparison of the potential of the two circuits by connecting them together by a bridge-wire 5, and the negative conductors, 2 and 4, by a similar bridge-wire 6. In these two bridge-wires is located a high resistance differential galvanometer *A*, with one coil in bridge-wire 5, and the other coil in bridge-wire 6.

Now, suppose the potentials at 1 2 to be represented by 200 on the positive conductor 1, and by 100 on the negative conductor 2, and that the difference in potential, 100, is the pressure it is desired to maintain constant in both circuits. Then, if the potentials are the same at 3 4, no current flows through the galvanometer, and the needle remains at zero. If at 3 4 there are potentials represented by 202 and 102, then in each bridge-wire and on each coil of the galvanometer there is a current caused by a difference of potential of 2. As in each bridge-wire this flows from circuit 3 4 to 1 2, the currents neutralize each other, and there is no deflection. This is a correct indication, since the difference of potential at 3 4 is still 100. If at 3 4 there are potentials represented by 202 and 104, the currents in the galvanometer coils will be in the same direction as before; but one being caused by 2 units and the other by 4 units, a deflection will be produced by the larger current, as it should be, since the difference of potential is 98 and not 100.

If at 3 4 we have 202 and 98, one coil of the galvanometer will carry a current from circuit 3 4 to circuit 1 2, and one from 1 2 to 3 4, and these currents will act together on the needle and produce a deflection, as they should, showing the difference of potential to be 104.

The circuit 1 2 is regulated by reference to its absolute indicator, while current 3 4, and as many other circuits as may be connected with 1 2 in the same manner, are regulated by reference to their respective instruments *A*; or these instruments can be utilized to effect the regulation automatically, as will be presently explained.

In Fig. 2 the application of the invention for indication upon a two-wire system of distribution is shown. The street mains are illustrated by 7 8. From the street mains at points *B*, *C*, and *D*, are taken feeders 9 10, supplying current to the mains from the central station, and corresponding with the feeders, are pressure wires 11 12, running from points *B*, *C*, and *D* on mains back to the station. The feeders have hand adjusted resistances *R* for regulation, as shown in Fig. 3, or an automically adjusted resistance as shown in Fig. 4.

To the pressure wires from *B* is connected the absolute indicator *E*. Bridge-wires 5 6 connect an extra set of pressure wires, 17 18, from *B* with those from *C* and *D*, and in these bridge-wires are located the differential galvanometers *A*. Thus indications will be had for regulating the three feeders to keep the desired pressure at the points *B*, *C*, and *D*.

For a three-wire system, the pressure at *B*, between positive and neutral and between neutral and negative, is shown upon two absolute indicators, while four comparative indicators show whether or not the pressure at *C* and *D* is the same as at *B*.

The comparative indicators have a particular advantage in connection with a three-wire system of distribution, since they enable it to be determined whether current is flowing over the neutral wire of any feeder by a direct comparison of the potentials on the neutral wires of the two or more feeders. This is done by simply breaking the bridge-wires connecting positive conductors, as well as those connecting negative conductors, leaving the bridge-wires between neutral conductors alone in connection with the instruments. The comparative indicators then act as simple galvanometers, and show the differences in potential between the neutral conductors. Since the flow of current on neutral conductors indicates an unbalanced system, the comparative indicators enable the fault to be located and remedied.

Referring to Fig. 3 it will be seen that an incandescent electric lamp *A'*, forming a fixed resistance, is connected with omnibus wires 13 14 in the station, and has adjustable resistance *R'* in series with it. An absolute indicator *E* is connected in multiple arc with the lamp *A'*, and by adjusting *R'* with reference to *E* the lamp can be kept at a candle-power giving the difference in potential between the lamp terminals that is desired for the outer ends of feeders. The bridge-wires, with their comparative indicators, are connected between the feeder pressure wires and wires 15 16, running from the terminals of the lamp *A'*.

The regulation may also be effected automatically by the apparatus shown diagrammatically in Fig. 4. In this arrangement, the arm of the differential galvanometer is shown connected constantly with one mercury trough *c*, and standing normally between two others, *d* *e*, and in this way, by the connections shown, controlling two circuits to the intermediate resistance-adjusting mechanism *G*.

Electric Street Cars.

The attendance at the opening dinner and meeting of the season of the American Institute of Electrical Engineers, at Cable's restaurant, on Dec. 7, was large, over 50 members and visitors participating. Among those present were M. Julien, Mr. S. D. Field, Mr. Van Depoele, Mr. J. M. Pendleton, Capt. Michaelis, Mr. G. A. Hamilton, Mr. C. O. Mailloux, Baron de Caters, Mr. G. W. Mansfield, Mr. J. M. Mitchell. The subject of the evening was "Electric Street Cars," It was freely discussed in a manner showing that electricians look to street railways as their next field of successful occupation, as already demonstrated by a variety of electric roads.

Work of the Julien Electric Car in Hamburg.

The electric tramcar at Hamburg, Germany, which is operated by storage batteries on the Julien system, was described and illustrated in our issue of July 21, 1886. It has now been in operation since last April with continued success. The length of the line is about 5,250 metres,* or 3¼ miles, and the electric car being run simultaneously with the horse-cars, it is consequently limited to the same speed as the latter, that is, about 12,600 metres, or 8.8 miles an hour. The accompanying diagram illustrates the fluctuation in the power required to drive the car; the horizontal lines indicating the number of watts, and the verticals the time in successive minutes; the entire trip occupying 25 minutes.

As the diagram shows, the grade on the line is very irregular, especially during the passage of the bridges

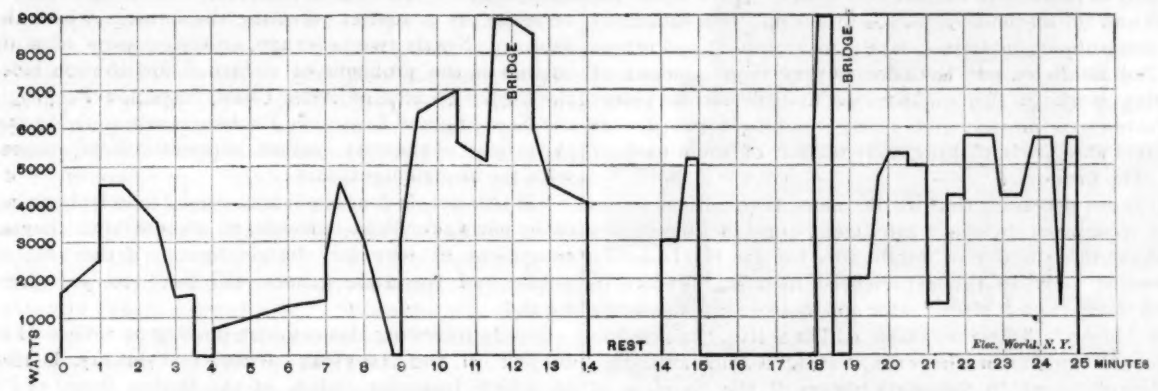


DIAGRAM OF POWER REQUIRED BY JULIEN CAR, HAMBURG.

where 4 per cent. grades are encountered. At such times the electric work measured at the terminals of the motor is 9.000 watts, or 12 electric horse-power. The total work done during a single trip of 3¼ miles (5,250 metres) is about 1,600 watt hours; that is, about 305 watt hours per kilometre run, which represents $\left(\frac{305}{736}\right)$† 0.414 electric horse-power hour. In reality the work per kilometre is greater than the figure just given, for the diagram shows that during 4¼ minutes the power expended is nil during the descent of the bridges; but, in comparing it with the total run, this must also be taken into consideration.

Taking as a basis 1,600 kilometres run by the car, the power required to charge the accumulators, measured at the terminals of the latter, and hence representing the power stored, was 935 electric horse-power hours, or 0.585 horse-power per kilometre run. The ratio of work done to work stored is, therefore, $\frac{0.414}{0.585} = 71$ per cent. As stated above, in order to obtain the exact efficiency, it would be necessary to take into account the 4¼ minutes during which the train is propelled by gravity alone.

From the above figures, which are the mean of daily averages, M. Julien calculates that if the generator have an efficiency of 80 per cent., the motive power required for one car-kilometre is $\frac{0.585 \times 100}{80} = 0.73$ horse-power hour. This figure agrees well with that found by the jury of award who conducted the tests of M. Julien's car at the late Antwerp Exhibition.

M. Julien, therefore, deems himself justified in claiming that for one kilometre run, the work or energy required on his system is ¾ horse-power hour, which is equivalent to 1.2 horse-power hour per *car-mile*. These figures show that only a small loss is met with in the accumulators, .57 electric horse-power hour being indicated at the terminals of the motor.

Taking the energy required to drive the car, 1 kilometre to be 0.73 horse-power hour, and assuming that the engine plant consumes 3 pounds of coal per horse-power per hour, the coal required to drive the car one kilometre is 2.19 pounds. Reducing to English measure we would have $\frac{8 \times 2.19}{5}$ or 3½ pounds of coal per car-mile. It may be added that the weight of the Hamburg car varies from 7 to 8 tons, according to the number of passengers carried.

The New Canada-Pacific Cable.

With regard to the new cable between British Columbia and Australia, a dispatch of Dec. 3, from Ottawa, says: Mr. Sanford Fleming, one of the projectors of the company, who is in this city, states they are receiving every encouragement from the governments interested, including Great Britain, Australia, Canada and India. It will give the British government communication with India and Australia, without having to depend on the Mediterranean route, in the event of rupture between Great Britain and any Mediterranean power. It is proposed to run a chain of cables across the Pacific Ocean, from Brisbane or Sydney to the north of New Zealand; from New Zealand to the Fiji Islands; from the Fiji Islands to the Fanning Islands; from the Fanning Islands to the Sandwich Islands; from the Sandwich Islands to Barclay Sound or Vancouver Island; thence across to the new city of Vancouver on the mainland, the terminus of the Canadian Pacific railway. That completes the Pacific section of the line. The land line across the continent will be used to Gaspe, where a cable would be laid through the Straits of Belle Isle to the United Kingdom, unless it is found possible to secure control of one of the existing lines across the Atlantic. There is at present a cable running from Australia to India, which, as before stated, would give the British government communication with that, her most important possession, without utilizing the Mediterranean route. The Hawaiian government has already offered an annual subsidy of $20,000 if the Sandwich Islands are included in the scheme. Large numbers of English capitalists are interested, and there is no doubt, Mr. Fleming believes, of its success.

The Secretary of State for the Dominion stated to your correspondent that the Dominion government was ready at any moment to encourage the project by way of subsidy so soon as all the other governments have stated what they are prepared to do. Mr. Fleming, it will be remembered, was for a number of years engineer-in-chief of the construction of the Canadian Pacific Railway.

* The kilometre, or 1,000 metres, is equal to ⅝ mile, nearly.

† The French and German horse-power is equivalent to 736 watts, and is, therefore, about 1½ per cent. less than the English h. p. (746 watts).

A New Mather Dynamo.

Where long lines having many arc lamps in circuit are employed, it is the practice to connect two or more

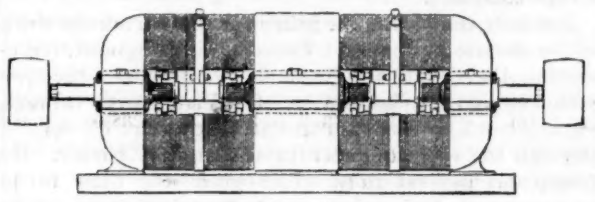


FIG. 2.

dynamos in series, so as to obtain the required electromotive force. These machines are, as a rule, governed independently, and where arc and incandescent lighting currents are supplied from the same station, separate machines are, to a large extent, employed. It was to avoid these difficulties that Mr. R. H. Mather, the electrician of the Mather Electric Light Company, designed

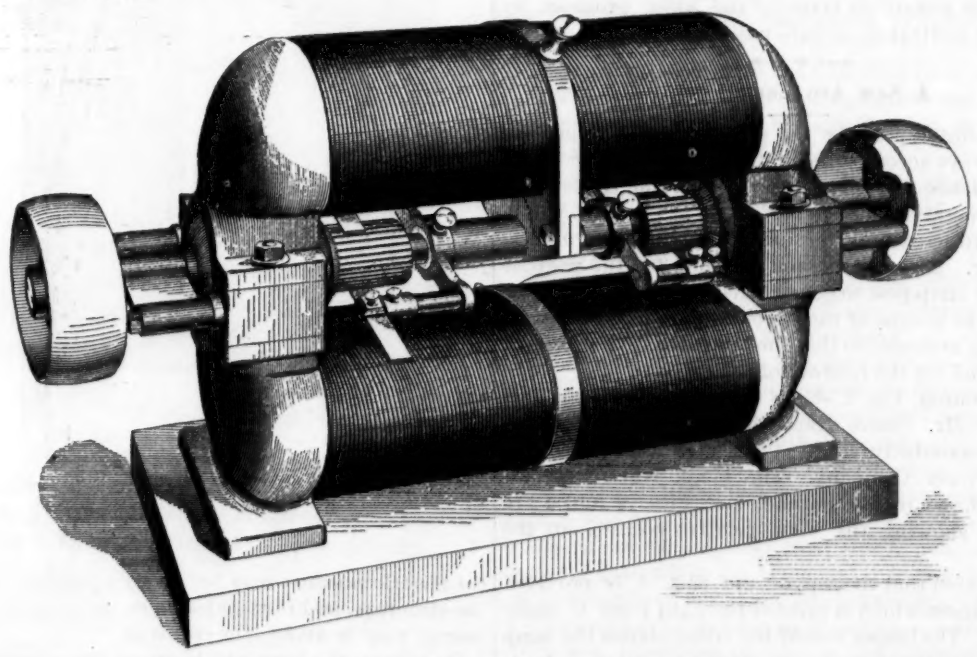


FIG. 1.—A NEW MATHER DYNAMO.

the machine shown in the accompanying illustration, Fig. 1. In this machine, it will be noticed, a single magnetic circuit is utilized for the production of two magnetic fields, in each of which revolves an armature, both armatures being mounted on the same shaft. By this means, Mr. Mather claims, the construction is greatly simplified and cheapened. The field magnets consist of only two castings, the upper one having a lug at the centre for the support of an apron which carries the centre bearing of the shaft.

The pole pieces between which the armatures rotate are separated by brass blocks, which also carry the outer bearings of the armature shaft.

The armatures are both driven at the same rate from two belts, and, being connected in series, generate twice the E. M. F. which each develops singly. There are thus practically two machines mounted on a single base. This admits of economy, both in material and in the room occupied by the machines.

The illustration, Fig. 2, shows a modification of the same idea, three armatures being combined and under the influence of a single pair of field magnets.

While, as stated above, the armatures may be connected in series to the same circuit, they can evidently also be run on independent circuits, thus taking the place of two machines.

The Electrical Exhibition and Pure Research.*

BY PROF. M. B. SNYDER.

As we take our parting glance of the fascinating and successful exhibition, we may sum up all in the statement that electricity is now subject to accurate measurement. The magnetometers, electrometers and galvanometers and the multiplicity of meters that measure every condition of electrical action, stand as the crowning result of theoretical and experimental electricity. If we ask why the instruments are of such and such forms, we are referred to the mathematics; if we inquire how they are used, we learn also the necessity of acquiring the art and practice of experimentation; if we inquire upon what general method the measurements are made, we are sent all the way back to the great astronomer Gauss, to learn of him the absolute system of expressing forces, and if we ask for the unit of measure, the yard-stick of the practical electrician, the so-called ohm, we have to intercede with the long line of eminent physicists, beginning with Wilhelm Weber and ending with Rayleigh and Rowland, for a copy of their standards.

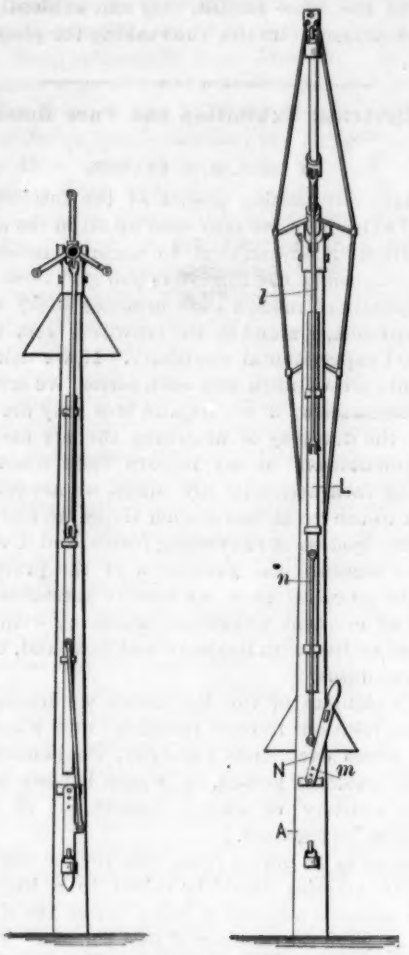
In every element of the Exhibition we detect the most undoubted relations to pure research; and when we run over the scene even thus cursorily, we behold pure research the presiding genius, on whose behests depend the successful activity of every department of electrical practice here represented.

The lessons to be drawn from this review are evident. Research in America should be raised to a higher plane and such methods adopted to bring about the desired result as may have the sanction of past success. The reason why there are not more American names associated with the progress of physical research (and there are many more in this department than we have had occasion to mention) does not lie in the lack of interest or the lack of power in the American student. Apart from the materialistic spirit that we all imbibe, there is the lack of appliances and particularly of the unrestricted devotion that such work demands.

Speaking of appliances it is at least in the separation from first-class scientific libraries that the American student suffers untold inconvenience. European students in physics would be amazed to learn that in an American city of nearly one million of inhabitants, there could not be found a complete set of, say, *Poggendorf's Annalen* or *Crelle's Journal*, or an instance of other volumes which it were occasionally desirable to refer to, in order that experimentation might start in at the right point and lead to the right end. Especially, however, do we wish to insist on the fact that sufficient opportunity is not afforded for that jealous, single-minded attention which science requires. It is not that large endowments are not given to erect fine buildings for laboratories or to provide fine instruments. But it is that there are but few foundations which put the man back of the instruments and allow him to devote himself with undisturbed purpose to the

* Portion of lecture delivered before the Franklin Institute.

work of his laboratory. If you will recall the influence of but one institution where a foundation is provided which places an unhampered man in the laboratory, you will appreciate the justice of these remarks. The Royal Institution of London was founded, we are told, to promote, among other things, scientific research. To do this it founded a professorship, which gave the incumbent free scope to follow out researches of the purest type. You know what has been done for electrical science by its professors, Davy and Faraday. They discovered the decomposition of the fixed alkalies, the laws of electro-



FIGS. 2 AND 3.—A NEW ARC LAMP-POST.

chemical decomposition, the fact of magneto-electric induction and the two-fold magnetism of matter, together with a whole body of general information on electrical subjects. You know then how deep a debtor our Electrical Exhibition was to this single foundation for the promotion of research. It need only be said that the prospect is clearly open of doing not only important service to science, but some day to humanity at large, by diverting some of the American wealth to such noble foundations. May we not hope that our public-spirited citizens will thus endow our own institute, an institution in many respects similar to the one just mentioned. Such a happy result would certainly show that America was not altogether oblivious of its lasting obligation to the contributions already made toward its material and social progress, by the eminent cultivators of pure research.

A New Arc Lamp-Post.

The climbing of posts for the purpose of trimming arc lamps is always accompanied with more or less inconvenience, and hence a ready means of lowering the lamp so that this operation may be performed at the level of the street has attracted the attention of those engaged in electric lighting. A recent method designed for the purpose consists in a lamp-post so constructed that the lamp is suspended in the middle of the street, instead of on one side, and which is arranged so that the lamp can be lowered for inspection and for the renewal of the carbons.

Our illustration, Fig. 1, shows a view of the new post designed by Mr. James Hammerstein, of Terre Haute, Ind., and manufactured by the Terre Haute Electric Light and Power Company. The lamp, when lowered, appears as shown in the outline, and Figs. 2 and 3 are rear views showing the same relative positions of the lamp.

It will be seen that the top of the post *A* is provided with a cap, upon which is pivoted the light truss *C* made of gas pipe. The longer arm of the latter carries the lamp at one end, and the shorter arm carries a counter-balancing weight at its end. The truss or sweep is tilted by means of a sliding bar *L*, secured to the side of the pole in bearings, and connected with the counterpoise end of the sweep by a diagonal connecting rod *l*. The upper end of the latter is hinged to an adjustable collar *M*, on the sweep *C*, and its lower end is hinged to a lug on the bar *L*. The bar *L* is slid by means of a lever *N*, pivoted at one end to the pole and connected near its centre with the slide *L* by means of the connecting rod *n*. The end of the lever secured to the pole is provided with a series of perforations *m*, for adjusting it to the standard at different distances from its connection with the connecting rod *n*. In addition, the handle end of the lever is provided with a slot *O*, which slips over a hasp, so that it can be locked by a padlock.

The operation of the device is so apparent from the illustrations that no further explanation seems necessary. It will be observed that the adjustment of the rod *l* at different distances from the sleeve *B* and the adjustment of the lever will cause the sweep to tilt more or less, as may be required. A bracket on the standard near the top supports the wires, and they lead from thence over a spool on the truss to and from the lamp.

The Business of the "Electric Light Fitter."

It has more than once been our endeavor to arrest attention on the importance of good work in the wiring of houses and other buildings for electric lighting. The fact is that the success of the incandescent light has been largely dependent in the last two or three years upon the skill and the methods employed in wiring. In a statement on this subject, addressed lately to architects and others by Noll Brothers, who have done a very large amount of wiring work in this vicinity, we find the various points involved so admirably and clearly brought forward, that we feel pleasure in making reproduction of some parts of it. The firm say:

It is not necessary that we do more than allude to the fact recognized by every intelligent construction expert that the introduction of conductors for gas can be safely intrusted only to the experienced mechanic known in former days as a "piper," later and more comprehensively as a "fitter." There are those still in active business life who well remember the exasperating results attending the employment, in the early history of the business, of contractors whose ideas were not based upon extended practical knowledge, and to-day a reputation in this branch of applied requirements of distribution growing out of the experience of the gas companies is the first requisite to successful competition.

Two of the most vital conditions of gas distribution are adequate capacity of conductors and freedom from leakage. That the former cannot be left to chance, but must be reached by intelligent computation and arrangement, is self-evident even to the novice in building operations. The tendency of gas to escape and cause violent explosions has led to a vigilance in construction work which has in later years been so universally recognized as almost to escape comment.

Precisely similar are the principles underlying the work of the electric light fitter. The electrical engineer, representing the illuminating company, determines the laws which govern the distribution of electric energy through the conductors, which radiate from the electric service through the electric meter to the electric burner. He formulates general rules which guide the fitter in so grouping and placing these conductors that they may be controlled by main and branch line electric cocks, that the electric pressure may be nicely equalized throughout the structure, and that all leakages or escapes of electric energy may be avoided or removed.

He reduces the laws which govern the proper placement of the electric lamp so that the peculiar advantanges which it offers over any medium evolving light by combustion may be made available, and its use economical. In short, he directs the transformed and harnessed energy of the steam boiler or the water reservior with that systematic study and watchful care which its potency as well as its usefulness demands.

These considerations are sufficient to impress upon every investor, as well as his mechanical agent, the prime importance of committing the matter of the electric light installation to the best obtainable talent. In the progress of the gas business there have been numbers who have attempted, usually with small measure of success, to cope with the problems of a specialty not covered by their education.

Even so in electric lighting, while the industry is yet young, there is especially great danger of encountering those who, without a conception of the seriousness, as well as the intricacy of the task to which they set themselves, blindly propose to contract to place anything to which a limited knowledge of bell wiring, watch, clock or burglar alarm work gives them confidence to aspire. To the credit of the electrical fraternity, be it said that all thoughtful, observing firms in these branches honestly acknowledge their inability to undertake a work which is as foreign to their experience as is the piping of a building for the distribution of gas to the placing of a system of speaking tubes.

Naturally the Fire Underwriters were among the first to recognize not only the desirability of securing the general advantages of intelligent supervision, but its absolute necessity as a matter affecting the hazards which they assume. Nearly two years ago, on the occasion of a discussion on the problems of electrical distribution before the Boston Society of Arts, Chief Inspector Brophy, of the New England Insurance Exchange, whose field covers the ground of the very earliest commericial experiments with the electric light, said:

"It will not do for people well versed in telephone and other wiring for light currents to assume that they are competent to wire for electric lights; if they do, the public and the underwriters will have to pay dearly for it."

Closely following this came an intelligent review of the subject in the *American Architect* (February 7, 1885), in which Inspector Cabot, of the Boston Board of Fire Underwriters, tersely embodied the same idea:

"I would advise all persons intending to have wires put into any building, to employ the services of an electric company for this work, and not intrust it to men who are only accustomed to wiring for electric call-bells, gas lights and the like. The work of putting in wires for electric lights is a very different matter from any other kind of wiring, and requires a knowledge of electrical resistance and of the heating power of electric currents, which most of the bell-hangers by no means possess."

In many cases such contracts have been undertaken largely as the result of the presumption that though the wires may be placed, no current will be carried by them for years, if ever.

Thus, without even knowing the actual requirements, dishonest competition secures contracts at nominal prices, and trusts to circumstances to escape the results which time is certain to develop.

It is worthy of note that very few if any instances are on record where wires thus placed have ever served their purpose without extensive alterations, and often entire reconstruction.

It is evident that the troubles which follow are the source of extreme annoyance and great expense, especially where a system is installed and the conductors are covered during construction, and that no guarantee can adequately protect the investor who is obliged to submit to the inconvenience of a change.

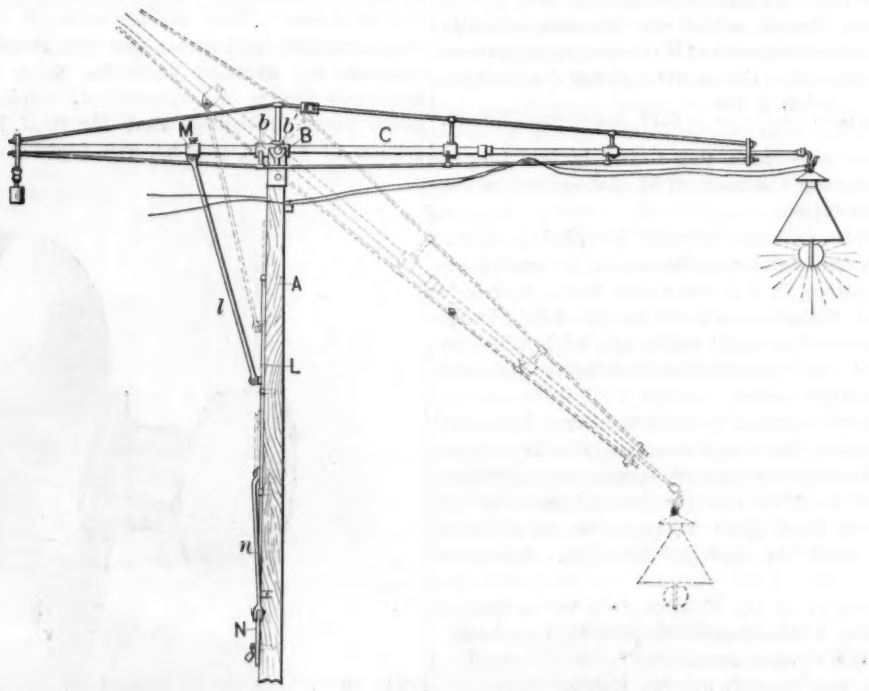


FIG. 1.—A NEW ARC LAMP-POST.

An Electric Railway for New York.—Several plans for electric railways in New York are maturing, and it seems likely that the details will shortly be made public. One striking move in the direction of using electricity is noted. A franchise has just been granted that will cover a road on Fulton street, crossing Broadway. Such a road will be of great service, and its necessity has long been felt. The interesting feature is that the road is to be operated on the Bentley-Knight system, using a conduit. The system was first tried at Cleveland, and has for some time been in successful operation on a short track at the Rhode Island Locomotive Works, Providence.

Delay in Delivering a Cable Message.

Mr. J. S. Moore complains in the papers that a cable message sent by him on the night of Nov. 28 at 8:30 from this city to London was finally, after inquiry on his part, delivered on Wednesday, Dec. 1, the only explanation being that the address was indistinct. "Such," he says, "was the adventure of a cable message sent by me through the Western Union. Of course I gave the matter over to my lawyer, and will not say anything about the nature of the loss. But I want to call the attention of the public to the cable service which held an indistinctly addressed message from Monday morning until Wednesday, and did not cable back to its office that the address was indistinct, which, by the bye, it will be shown in good time was distinctly written. This is the duty of any office on receiving messages which cannot be delivered. And to crown the injury with insult, I have not received any written explanation, nor, in fact, any word from the Western Union on the subject, except when to-day I went to see the polite superintendent in Broad street, who gave me some answers upon my inquiries. Now, apart from any individual hard usage, am I the only victim of this careless service? Of course I am the exception who promptly shows this cheap, doubtful service up. The best explanation and excuse the Western Union in such cases could make would be the answer 'Polly' made to a drunken sailor in London who treated her to 6d. worth of gin. On his complaining that Polly had lost the tip of her nose, she haughtily shrieked: 'Do you expect a nose for 6d?' What can we expect for 6d. in cabling, although the pretense and assurance are as strong as if the rate were 50 cents a word?"

Electricity and Agriculture in Russia.

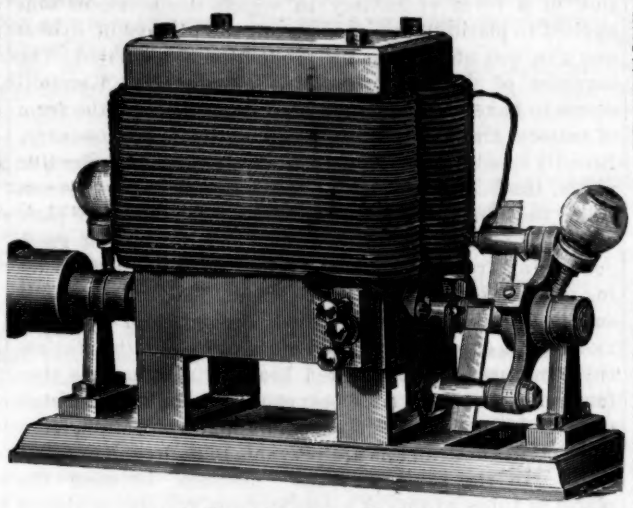
The proprietor of the Russian journal, *Selsky Khosiane*, has recently made an enterprising and philanthropic attempt to bring electricity to the assistance of the struggling and distressed agriculturists of Southern Russia. It is stated that the Russian wheat growers are being absolutely ruined by American and Indian competition, and that their only chance is to thrash out their grain and place it on the market for export at the earliest possible moment. It is therefore extremely desirable that thrashing operations should be prolonged as late as possible in the evening. But to thrash by the aid of oil lamps, with loose straw all over the place, is simply to court disaster. To meet this difficulty, the proprietor of the *Selsky Khosiane* has interested himself in the introduction of electric light. The Stepanoff primary battery, which is described as a modification of the Daniell, is said to have been used at Riazin with much success. Two or three lamps of 8 candle-power are found sufficient.

The Effect of Stress and Strain on the Electrical Resistance of Hard Carbon.

On this subject Mr. Herbert Tomlinson communicates the following note to the November number of the *Phil. Mag.*: "Prof. T. C. Mendenhall has published in the September number of *Silliman's American Journal* an account of some experiments on the effect of pressure on the electrical resistance of carbon. These experiments deal not only with such comparatively hard rods of carbon as are used in the arc lamp, but also with the compressed lamp-black seen in Edison's discs. I will first refer to the experiments on the hard carbon. Prof. Mendenhall seems to think that these are in accordance with some experiments made by myself; but this I rather doubt, for the change of resistance produced by pressure on the carbon rod used by him would appear to be considerably greater than any kind which was obtained by myself on carbon rods of a similar kind. Had I not employed a very sensitive arrangement for testing small changes of electrical resistance, one which in fact enabled me not only to detect, but to measure a change of resistance of about 1 in 100,000, I might have failed in detecting any change whatever. The result arrived at by myself was that a pressure of one grm. per square centim. would produce a percentage decrease of only .00000064. So that, if we assume the decrease of resistance to be proportional to the pressure, there would be required a pressure of 22,215 lbs. on the square inch to produce a decrease of resistance of 1 per cent. There is reason to believe that the pressure which would suffice to crush carbon is somewhere about 5,000 lbs. per square inch. If this result be at all correct, it would follow that pressure on the point of crushing the carbon would diminish the electrical resistance by less than ¼ per cent. Professor Mendenhall does not give any data by which the amount of change of resistance observed by him can be calculated; but, if one may judge from the tenor of his remarks and his arrangement for experimenting, it would seem probable that the ratio of change of resistance to pressure was considerably greater in his experiments than in mine. Further, Prof. Mendenhall seems to credit me with doing what I have not done; for, after describing his own experiments on the effect of pressure exerted in the same direction as the current, he goes on to say: 'It was also found that compression at right angles to the direction of the current produced a similar effect, but less in magnitude. These facts had been already announced by Mr. Tomlinson.' I have made no experiments on the effect of compression at right angles to the direction of the current, but I think it probable that if I had, I should have found increase of resistance, and not decrease, to follow on compression exerted in the above direction. On the whole, then, I am of opinion that my experiments are more in accordance with those of Professors Sylvanus Thompson, W. F. Barrett, and others, than with those of Prof. Mendenhall."

A New Plating Dynamo.

Our illustration represents the machine lately designed by the Redding Electrical Company, of Boston, for plating purposes, where the amount of current required is not very great. The magnets, of the inverted horseshoe type, rest on non-magnetic bases, and they are charged by a special current, so that no reversal of polarity can take place. The machine is compact and well made.

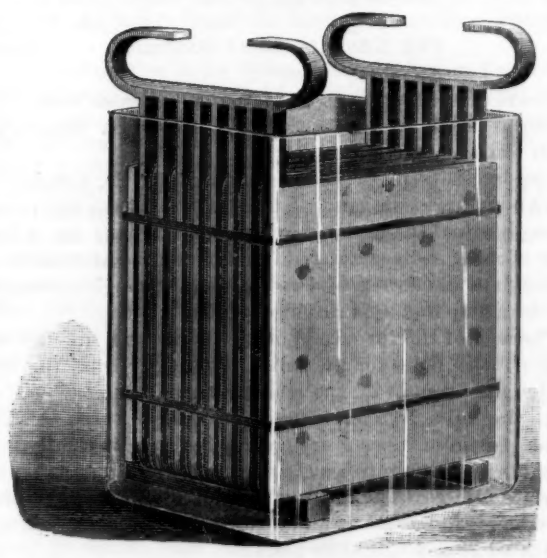


A NEW PLATING DYNAMO.

The Storage Battery of the Electrical Accumulator Company.

We have previously announced that the works of the Electrical Accumulator Company, of this city, which are situated in Newark, N. J., are already engaged in the manufacture of storage batteries. The high standing in electrical circles of those interested in this enterprise makes it desirable to call attention to the features of this battery as set forth in the descriptive pamphlet of the company, just issued. In view of the many uses to which the storage battery can be put, the entrance of this company upon active business operations is an event of more than ordinary importance.

The standard size of cell manufactured by the company is known as the "15 A," and is made up of fifteen plates, eight negatives and seven positives. Our illustration gives a view of the general appearance of the cell, and the following are the details of its dimensions and capacity:



NEW STORAGE BATTERY OF THE ELECTRICAL ACCUMULATOR COMPANY.

Floor space, 8½ × 11 inches.
Height, 16½ inches
Weight, 125 pounds.
E. M. F, 2 volts.
Capacity, 350 ampère-hours.

The cell is designed to give 35 ampères for 10 hours, but can, of course, be drawn on for a greater or less amount as required. Its internal resistance varies between .001 and .005 ohm.

The plates consist of leaden grids, filled with the active material and separated by insulating material, and are prepared on the Faure principle, as improved by Swan, Sellon, Volckmar, Shaw, and others. They are similar to those made in England by the Electrical Power Storage Company.

The efficiency of these accumulators is guaranteed at 80 per cent., and their life is insured at two years, when used according to instructions.

Telephone Subscribers in Europe.

From data furnished him by Mons. A. Berthon, of the telephone company, Paris, France, Gen. Barney, the secretary of the National Telephone Exchange Association, has compiled the following table of exchanges and subscribers in Europe:

COUNTRIES.	Exchanges	Subscribers.	Largest exchange.	No. of subscribers in largest exchange.
Germany	91	14,733	Berlin	4,248
Austria	11	3,032	Vienna	946
Belgium	7	3,365	Antwerp	1,020
Denmark	2	1,370	Copenhagen	1,336
Spain	3	594	Barcelona	200
France	20	7,175	Paris	4,054
Great Britain	19	15,114	London	4,193
Italy	16	8,546	Rome	2,054
Holland	8	2,493	Amsterdam	1,195
Portugal	2	350		
Russia	20	5,280	St. Petersburg	1,100
Sweden	15	5,705	Stockholm	3,825
Switzerland	36	4,900	Geneva	1,068
Total	320	72,457		

These figures present a remarkable contrast with those of the exchange statistics of the American Bell Telephone Company brought down to January, 1886. From the data furnished by the company's statistician, it appears that on the first day of the present year there were in the United States 747 exchanges with 137,750 subscribers, or more than twice as many exchanges and nearly twice as many subscribers as in the whole of Europe, in spite of the fact that the countries enumerated above have a population five or six times as large as that of this country. The cities of the old world and the new offer other contrasts as notable. Thus, London has only 4,193 subscribers, or fewer than New York, notwithstanding the immense disparity in population. St. Petersburg, the capital of all the Russias, has barely half as many as Kansas City. On the other hand, some of the smaller cities, such as Stockholm and Copenhagen, compare very favorably with American cities of the same size, owing to the local cheapness of service.

The Erie Telephone Decision.

The suit of William H. Bent against the Erie Telephone Company has been decided in favor of the company by the arbitrators.

The full text of the decision of the arbitrators is as follows: The undersigned, arbitrators by virtue of the commission and agreement hereto annexed, and in accordance with their provisions, met the parties on the 14th of April, 1886, at the office of George A. Bruce in Boston at eleven o'clock A. M., after due notice. Both parties were present by their counsel, and the hearing having commenced was adjourned from time to time, at the request and by the agreement of the parties, until Nov. 20, 1886, when it was concluded. At all the many hearings the parties were represented by their counsel—the plaintiff by George F. Richardson and M. F. Dickinson, Jr., and the defendant by B. F. Butler, J. N. Marshall and W. H. Anderson.

The arbitrators, having examined the papers and vouchers, and heard all the allegations, evidence and arguments submitted by both the parties, and having carefully considered the same, find the following facts:

First—That the services of the plaintiff and money paid by him, as set forth in his specification, so far as such services and payments are proven, were rendered and paid gratuitously without the expectation or understanding on the plaintiff's part that payment should be made therefor to him by the defendant or by any party directly or indirectly represented by the defendant.

Second—That the note for $8,000, the balance of which is claimed in and by the plaintiff's specification, was given for money borrowed by the defendant of the plaintiff; that payment of said note was demanded by the plaintiff; that the parties met for the purpose of adjusting said note, and without either fraud or misunderstanding agreed upon a settlement of said note with a discount of about $1,000, such discount being the balance claimed by the plaintiff's specification from the face value of said note in full settlement of said note; that such payment was thereupon made by the defendant and said note was thereupon delivered up by the plaintiff to the defendant. It was the intention and agreement of both parties that the defendant should be discharged from further payment upon said note. The arbitrators, intending to save to the plaintiff any legal question which may arise upon the facts found as above, report and award that the defendant is not indebted to the plaintiff as he has in his claim specification alleged against the defendant. There was no evidence submitted to the arbitrators to sustain the set off filed by the defendant, and the arbitrators report and award a disallowance of the same.

The arbitrators further report and award that the defendant recover of the plaintiff the fees and expenses of the arbitrators which have been paid by the defendant, amounting to $3,735.93, the defendant's witness fees before the arbitrators, amounting to $53.60, and costs of court, to be taxed by the court. The amount of fees and expenses charged by the arbitrators as above is in accord-

ance with an agreement relating thereto, signed by both parties, a substantial copy of which is hereto annexed.

(Signed) JOHN H. GEORGE, CHARLES H. ALLEN, WILLIAM D. CADWELL, } Arbitrators.

LOWELL, June 4, 1886.

In the matter of W. H. Bent *vs.* the Erie Telegraph and Telephone Company, which has been referred under the statutes to John H. George, Charles H. Allen and William D. Cadwell, as a board of arbitration, it is agreed that the said arbitrators shall be paid, in addition to their expenses, the gross sum of $125 per day, the same to be taxed as costs as provided in the agreement of reference to said board.

(Signed) WILLIAM H. BENT,
Erie Telegraph and Telephone Company.
By W. H. ANDERSON, Attorney.

The decisions in the Ingham and Downs cases against the company were rendered in a similar manner as the above, all in favor of the defendant company, Ingham and Downs to pay whatever costs they have incurred. In addition to the above award, Bent has counsel fees to pay.

On the Electric Resistance of Magnetite.

BY PROF. SILVANUS P. THOMPSON, D. SC.

This is a preliminary note on a research begun with the view of elucidating the question whether the conduction exhibited by various mineral ores and metallic oxides and sulphides possessing quasi-metallic conductivity is or is not accompanied by electrolysis. The substance selected, magnetite or magnetic iron ore, is a thoroughly good conductor, as is evidenced by the simple fact that if a piece of it be interposed in the circuit of an ordinary electric bell, the bell can be rung through it.

The sample selected was a fine homogeneous piece of ore from Arkansas, and was reduced by the lapidary's wheel to parallelipipedal bar. Its total length was 5.53 centimetres, its breadth 1.52 centimetres, and its thickness 1.27 centimetres.

The bar was placed between electrodes of platinum foil, which were clamped against its end faces by means of screws; it was then placed in a bath of paraffin oil, enabling it to be heated to any desired temperature up to 135° C.

To test for electrolytic polarization a current of about 1 ampère was passed through it from three nitric acid cells for some minutes. On stopping the current there appeared a slight polarization, not, however, exceeding 0.0005 volt, and therefore of an order indicating a thermo-electric, rather than an electro-chemical origin.

The specific resistance was then measured by observing the fall of potential between two marked points 3.22 centimetres apart upon the bar, and comparing this with the fall of potential between the two ends of a standard resistance coil, intercalated in the same circuit. The resistance was found to diminish very remarkably as the temperature was raised. Observations were made at intervals of from twenty to forty minutes apart, with the following result:

Temperature (C.)	Resistance of centimetre cube in B. A. units.
23°	0.719
54°	.709
79.5°	.505
107°	.416
133°	.287

It appears that the resistance of magnetite agrees with that of carbon and the electrolytes in possessing a negative temperature co-efficient.

A somewhat longer and thinner bar of hæmatite prepared for future experiments showed a resistance of about 108 megohms, which in a preliminary heating fell to 81 megohms.

The determinations were made by the author's chief assistant, Dr. R. M. Walmsley.

Winter and the Subways.

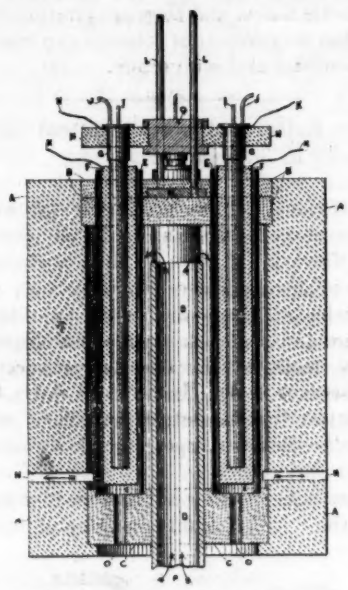
The near approach of winter puts a drag on the operations of the Subway Construction Company, although work in hand is being pushed vigorously to completion. Meantime the various electrical companies have met the assessment on them for subway commission maintenance. By the act constituting the Commission the State Comptroller was directed to audit the accounts of the Commissions, and having ascertained the amount to raise the same by assessment of the electric companies, who would be compelled to use the subway according to their miles of wires. By this plan the heaviest tax fell upon the Metropolitan Telephone Company, which has 6,014 miles of wire. Western Union came next, with 4,100 miles; United Lines, 1,032; Baltimore & Ohio, 618: United States Illuminating, 228; Brush, 203, and Edison, 56. According to the rate of tax something more than $35,000 will have been realized. The money goes at once to liquidate expenses already incurred during the 17 months' life of the Commission.

With regard to work on the Spring street section of underground conduits, the Averell Company is ready with a large amount of material, the iron pipes are on hand, and Contractor Crimmins has a big force of men prepared to dig up the street. It was positively announced on Monday that work would begin next day and be finished by the end of the week. The zinc tubes for the Fifty-eighth street section have arrived and are being treated with Averell asphalt.

Mr. Henry C. Andrews, as counsel for the Subway Construction Company, the Dorsett Company and the Subway Commission, filed the answer on Monday in the patent suit entered by the North American Underground Telegraph and Electrical Company, known as the Johnstone Company. The Johnstone Company has a month to file its replication, and then the struggle will begin.

The Kendall Heat Battery.

Some months ago, these columns contained a description of a form of battery in which the action of heat applied to platinum, so as to permit the passage of hydrogen gas, was utilized for the production of a current. The inventor of the apparatus, Mr. James Alfred Kendall, seems to have made substantial improvements in the form of battery, and has recently patented it in this country. Broadly speaking, the apparatus consists of two metallic plates, tubes, or boxes, with a saline or vitrified substance, called the "medium," between them. One metallic plate or tube is exposed to the hydrogen or a mixture of gases containing free hydrogen, the other metallic surface being exposed to heated air or oxygen. The inner tube is supplied in its interior with the hydrogen, and the exterior tube is exposed to heated air in a flue, so that the entire structure is kept at a red heat. Platinum has thus far been found to give the best results, though other metals can be employed, such as palladium, gold, iron, etc., since all of these metals are pervious to hydrogen at a red heat. In the same way the "medium" between the plates or tubes admits of a considerable variety, as almost any vitreous material not having a corrosive action on the metals can be used; or clay or earthenware saturated with



THE KENDALL HEAT BATTERY.

chloride of sodium, or potassium; or a porous refractory material—such as earthenware or fire-brick permeated with vitreous matters.

The latest form of battery adopted by Mr. Kendall is shown in the accompanying illustration, which represents a longitudinal section of a cylindrical furnace for a battery of four cells arranged in a circle, the section being through the centres of two cells and through the centre of the group and apparatus generally.

The wall of the furnace *A* of fire-brick has a fire-clay top disc *B*, with holes for the cells. The heat from the fire, which may consist of gas jets or a furnace, passes at *P* up into the tube *D*, and strikes the porcelain tubes *E*. The outer platinum tubes *F* are corrugated longitudinally, and the inner platinum tubes *G* are suspended from an earthenware disc *H*. The latter is provided with a metal plug *Q*, which can be slid up and down the iron rods *L L*, and adjusted at any height by a screw.

The hydrogen gas is conveyed to the bottom of the cells by the tubes *I I*, the waste of gas making its exit by the tubes *J J*. The conductors *K K* are attached respectively to the inner and outer platinum tubes. The heating gases from the furnace make their exit at *N*, after circulating around the tubes, and the holes *O* allow the atmospheric air to come in contact with the outer platinum tubes.

It will be understood that the vitreous or saline material described above and employed as the "medium" between the platinum tubes is added either in the liquid state or is fused in place by submitting it to intense heat. The porcelain tube *E* is employed simply for the purpose of protecting the cells and equalizing the heat, and also of preventing the furnace gases from adulterating the air supplied to the outer surface of the outer platinum tube. The production of electricity, as will be seen, depends upon the continuous absorption of hydrogen by the inner platinum tube and its passage through the medium and the other, outer tube to the oxygen on the outer surface of the latter, where a combination between the two gases takes place. The "medium," though normally not a good conductor, becomes conductive by the presence of the high heat and by the passage of the hydrogen.

The inventor claims that the passage of the hydrogen does not involve the decomposition of the medium used. "Whether the action is electrolytic—viz., by the aid of minute quantities of water in the red-hot glass, etc.," he says, "is not known, and might be very difficult to ascertain; but whether we assume the presence of water or not, the fact remains that currents of electricity of considerable power can be produced in this way."

New Weather Signals.

The chief signal officer of the United States signal service has issued a circular descriptive of the new code of weather signals adopted by the signal service for the inland stations, which are to be used on and after March 1, 1887. The indications are to be telegraphed as at present at 1 o'clock A. M., and are intended to cover the weather for the succeeding twenty-four hours, beginning at seven o'clock A. M. The signals to be used are as follows: No. 1, a white flag, six feet square, which will indicate clear or fair weather, no rain: No. 2, a blue flag, six feet square, will indicate rain or snow; No. 3, a black, triangular flag, six feet at the base and six feet in length, will always refer to temperature, and will be used as follows: When placed above No. 1 or No. 2 it will indicate warmer weather; when placed below these flags, it will indicate colder weather; when this black signal is not displayed in connection with either of the other signals the indications are that the temperature will remain stationary, or that the change will not be above 5° from that of the previous twenty-four hours. The cold wave flag is No. 4, a white flag six feet square, with a black square in the centre. This signal will not be displayed unless a temperature of 45° or less is expected, nor is flag No. 3 to be displayed with it.

Mr. Perkins's Message.

A colored man came into a telegraph office, and shuffling his way up to the operator's window, asked: "Kin I send a telegraft f'm here to my wife out in Hollyhock?"

"Certainly," said the operator. "Can you write?"

"Sartin, sah?"

"Well, here is a blank; write your message on that."

The colored man wrote slowly and painfully for some time, and then handed the message to the operator.

"Kin yer read dat writin', sah?" he asked.

"Oh yes," said the operator; "I can make it out." And he read aloud, slowly:

"TO MARTHA JANE PERKINS, HOLLYHOCK:

"*Train—done—disconnected;—home—two—A. M.—tomorrow—evenin'.*

"GEORGE WASHINGTON PERKINS."

"You kin read it!" exclaimed Mr. Perkins. "Now gub it back to me just one minute."

He took the message, brushed his thumb across the inky space around the ink-bottle, and then pressed the thumb vigorously against the surface of the paper.

"Here! What in the world did you do that for?" asked the operator.

"Ha! ha! Don't you worry 'bout dat," said Mr. Perkins; "when my Martha Jane see dat great big fumb dar on dis message, she know dat it was me dat sent it, shuah!"

Electrolytic Solutions.

M. Renard has conducted a series of experiments to demonstrate that the simple laws of electrolysis, which frequently do not seem to hold, become clearly apparent if sufficiently diluted solutions are employed. His solutions were of a concentration varying from 1, 2, 3, etc., tenthousandths up to 1,024 ten-thousandths. Of these solutions he took one litre, with a thermopile yielding 3.65 volts, and employing two electrodes of 226 square millimetres surface (3½ square inches). The negative electrode consisted of a platinum disc which was constantly moved to and fro by the arm of an electric bell in order to offer fresh liquid to the surface. The positive electrode was a plate of the respective metal. M. Renard summarizes his results as follows: In sufficiently diluted solutions the weights of metal precipitated are proportional to the degrees of concentration; the weights of metal are proportional to their chemical equivalents; and since, according to Faraday's law, these weights precipitated are also proportional to the current intensities, all metal solutions containing equivalent metal weights must have the same conductivity. This latter law had, by means of direct experiments, already been established by M. Bouty.

The Nature of Earth Currents.

M. Landeren, a French *savant*, has for years past been making observations on the nature and rôle of earth currents at the city of Tortosa, and some of his remarks thereon are worthy of note. He believes that he has discovered the existence of telluric currents produced by the wind, and he finds that the direction of the currents changes during whole months at a time. From various experiments with aërial lines, a Mascart electrometer and galvanometers, he obtains the result that when the telluric current and the wind are both in the same direction, or if the angle their directions form is under a right angle, the deflections of the observing instrument are of the same sign, but when the wind is directly opposite in direction to the current or at an angle over a right angle, the deflec-

tions are of a different sign. He concludes that the potential of the telluric current is very feeble and that the wind electrifies the earth rather than the wire, and develops in the earth a current of the same direction as itself, flowing through the soil over a large cross-section. While upon this subject, says *Engineering*, we may mention a published report from America (for the truth of which, of course, we cannot vouch) to the effect that Mr. Edison is occupying his mind with the problem of utilizing earth currents for telegraphic purposes. How he is to do it without the use of aërial wires is one of the mysteries of the report in question.

Electricity.

BY THOMAS O. WINSLOW.

Thou greatest of God's mysteries!
Vicegerent of creative power!
Who shall reveal thy histories,
Or say when dawned thy natal hour?
Millions of ages count as days
Since He thy wondrous mission planned,
And gave the mystic force that sways
Each orb which came at His command.

Feeder of dazzling central spheres,
Whose light and heat each system shares,
Thy power throughout all space appears,
And every star thy impress bears;
Each orbit fixed owns thy control;
All planets thy behests obey;
The universe, infinite whole,
Moves at thy will in perfect way.

Ruler of seasons on our earth,
Lord of the raging tempest's wrath,
Through *thee* the dread cyclone has birth
That leaves destruction in its path;
Through *thee* all life its stature swells,
Thy force upholds this breathing clay,
In which the godlike spirit dwells,
Withdrawn, it droops to swift decay.

Grand Alchemist! whose subtle power
Mocks at our human reason still,
In countless tints of plant and flower,
And gems beyond our mortal skill;
With combinations so complex
Of minerals and metals rare,
That earth's savants in vain may vex
The elements of earth and air,

To imitate the beauteous mold
Or grasp the wealth concealed within,
Where, hid from sight, the precious gold,
By baser ones, is claimed as kin;
To solve the mystery of each spring
That seems with subtlest healing rife,
Whose sparkling waters often bring
To wasted forms fresh health and life.

Thou shalt dethrone the monarch steam!
Make night like day through all the earth,
And realize the wildest dream
That poet's brain hath given birth;
Shall Christianize all savage lands,
And make one brotherhood of all,
United by thy mystic bands
Beneath each ocean's sombre pall;

Drive ships across the foaming main
With interchange of nations dower;
Speed cars o'er cities, vale and plain,
With silent but Titanic power;
Quicken the streets with nerves that thrill
Beneath the busy marts above,
With messages of good or ill,
Of business, pleasure or of love.

Agent of God! Man's servant now,
Yet ruling every action still,
Through occult force, we know not how,
But know our fate is but His will.
Through thee His power pervades all space,
Controls all life throughout the spheres,
Shapes all the destinies of our race,
And angels' course, through endless years.

Boston Transcript.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Dec. 6, 1886.

A. L. Bogart, 22 Union Square, this city, has now been manufacturing electric gas lighting apparatus since the beginning of the business in the sixties. From first to last he has invented and patented about fifty different appliances in his line, from the antediluvian hand electric gas-lighter down to the attractive little Bartholdi burner of to-day. Recognizing the fact that every successful manufacturing enterprise must, in the long run, base itself upon a thorough practical acquaintance with scientific principles, the head of the house had his son, Mr. A. Livingston Bogart, trained in the best technical institutions of Europe and America, and now enjoys his assistance in the business. Among the devices in which the experience and skill of the younger Mr. Bogart may be seen is the electric gas lighting cut-out, a most valuable adjunct to a house plant, never allowing the batteries to run down, but cutting them out after a few seconds in case the electrodes of a burner accidentally come together; also in his combined annunciator, burglar alarm and gas lighting cut-out. The house have, I understand, lately been sustaining their claims to the porcelain burner for multiple lighting by collecting royalties from some of the large theatres and churches in this city, on the ground of infringement.

Mr. C. B. Hotchkiss was in Philadelphia last week to superintend the connecting up of the incoming cable of the American (long distance) Telephone Company with the various offices now being established in that city for the business. He has supplied a number of kerite cables, from 10 up to 100 wires, for this purpose, to run in special conduits belonging to the company.

Mr. Benjamin Blum, who has been connected with J. H. Bunnell & Co. for the past seven years, resigned his position Dec. 1. The probabilities are that he will continue in the same line of business, and on his own account. His many friends wish him success.

Mr. Charles Wann has taken the general agency for the Union (Murray system) Fire Alarm Telegraph Company, 145 Broadway. Mr. Wann was previously connected with the Telemeter Company, and has had a varied and ample experience in general electrics. The company make special claims with regard to registering the alarm, giving the location on a dial in plain numbers as well as by signal. They have a very simple signal alarm-box, giving three separate signals.

Mr. W. B. Murdock originated some time ago the Applegate Electric Mat Company, with Mr. Bates as president. He is now president himself of a new company that proposes to introduce a novel electric time system. He is president, too, of a company with a new method of preserving fruits, etc.

Manning, Maxwell & Moore, 111 Liberty street, New York, have just received an order for the machinery and tools to go into the new shop of the Sprague Motor Company, New York City.

Mr. Henry Junge represents the Harburg India Rubber Comb Company at their New York office, 335 Broadway, N. Y. He is also general manager of the Excelsior Rubber Works, having their factory at 1 Adams street, Brooklyn. At the salesroom above mentioned are exhibited in stock and by a large illustrated catalogue a full line of hard rubber electrical specialties in every variety of insulator for the telegraph, telephone and electric light for office and house use. Thus there are telephone and microphone mouth pieces in over 100 styles; hard rubber battery cells and accumulator cases in about 200 styles, including a circular design employed in a Paris theatre to put on the back for illuminating ballet girls; rubber insulators in every conceivable modification; battery cells; sheet, rod and tube rubber in any quantity, shape or style; hard rubber "hardware," key knobs, handles, and a specialty in dental and stamp rubber. "Great is rubber!" one says involuntarily, looking over an assortment so interesting as this.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Dec. 6, 1886.

The Boston Gas Light Company and the Newton and Watertown (Mass.) Gas Light Company, have filed notices of petition in the office of the Secretary of State, asking the Massachusetts Legislature for authority to furnish electric light and power in the districts now supplied with gas by them respectively.

The isolated incandescent electric light plant recently installed by the Edison Company in the Narragansett Hotel, Providence, R. I., is to have one of the largest and most powerful engines ever turned out of the works of the Providence Steam Engine Company. It is of the Greene automatic type, and was made especially for this plant.

The aldermen of Cambridge, Mass., recently decided to accept the offer of the Cambridge Electric Light Company to furnish the city with lights for one year, at the rate of 55 cents per night for each light, and Mayor Russell has executed the contract with the company.

At a recent meeting of the Salem, Mass., aldermen, the committee on street lighting reported favorably for 54 additional arc lights for distribution on certain streets of that city not sufficiently lighted, and requested that a contract be made for the lights at an early day with the Salem Electric Light Company.

At the annual meeting of the Salem Electric Company last week, it was voted to increase the capital stock from $40,000 to $70,000, and a semi-annual dividend of 3 per cent. was declared The company has now in actual use 234 Thomson-Houston arc lights and 250 Thomson-Houston incandescent lights. Of the former, 129 lights are contracted for by the city for a period of two years, and it is reported that 54 additional arc lights will soon be ordered by the authorities. Officers for the ensuing year were elected as follows: President, C. H. Price; Treasurer and Clerk, Henry M. Batchelder; Directors, C. H. Price, S. Fred Smith, James F. Almy, I. P. Harris, Z. A. Gallup, B. W. Currier, Henry M. Batchelder and Geo. M. Harris.

The present lighting capacity of the Narragansett Electric Light Company of Providence, R. I, is 515 arc lights. When the plant was enlarged last spring only 300 lights were in use, while at the present time 485 are being run—two-thirds of this number being supplied to the city for street lighting. The selectmen of the suburban township of Johnson recently ordered 16 arc lights for lighting the streets, which will be ready for starting up before the holidays. Mr. V. A. Thomas, the superintendent of the company, said to me recently that "the stockholders realize the importance of again increasing the lighting capacity of the Narragansett plant, and probably steps would be taken in that direction soon after the opening of the New Year."

A special dispatch from New York, under date of Dec. 4, says: "The Brockton City District Telegraph Company filed its certificate of incorporation to-day in the County Clerk's office. It has a capital stock of $15,000, with the privilege of increasing to $25,000. The company is to run its lines of telegraph from Brockton, Mass., through that State and Connecticut to this city."

The Gamewell people are putting in an extension to their police telephone and signal telegraph system in Washington, D. C.—The installation of the Gamewell system in Buffalo, N. Y., is rapidly progressing. It will probably be ready for use Jan. 1.—The Gamewell Company's old system of fire alarm was put in the city of Toronto, Can., 17 years ago, and it is now being replaced by the company's new apparatus.

A new enterprise has been started at the Massachusetts Institute of Technology which is worthy of the support not only of the students, but also of the scientific public. It is a scientific quarterly similar to the *School of Mines Quarterly* of Columbia, but of broader range in subject matter. It will contain technical articles from the professors and students of all departments, including especially the results of experiments and research in the various laboratories. The following board of editors will have it in charge: W. C. Fish, W. C. Brace, W. S. Hadaway, Jr., B. C. Lane, S. C. Bartlett, from '87; J. T. Greeley, Sidney Warren, G. C. Dempsey, H. F. Bigelow and G. E. Claflin, from '88. The temporary officers of the board are: Chairman, J. T. Greeley; Secretary, W. C. Brace.

The Boston *Evening Transcript* of December 4 contained the following communication from Messrs. Cordley, Young & Fuller: The New England Telephone Company has for some three years back been directly under the able management of the Bell people, and is now paying 3½ per cent. per annum, or the equivalent of 8 per cent. on selling price, the dividend for the current quarter ending Dec. 31 to be 1¼ per cent., as agreed. The company has recovered most of the subscribers lost some time back in consequence of adjustment of rates, and now has some 19,000 connected—a pretty good evidence that the dissatisfaction has been overcome. There are no longer fears of any hostile legislation in Massachusetts this winter, the elections in the Lowell district having settled that feature. An important item in this connection is the fact that 90 per cent. of the stock of the New England company is owned in Massachusetts; and still another is that the company pays a corporation tax of $40,000, which entitles it to the protection of the Commonwealth. New England is now earning net nearly $25,000 per month, or at the rate of $300,000 per annum, while it only requires $245,000 to pay the 3½ per cent. dividend. Erie Telephone had quite an advance upon withdrawal of Downs & Ingham suits Wednesday, and upon the final decision of arbitrators in the Bent case. This ends Erie's lawsuits, and there is a probability that its cash surplus may be divivided among its stockholders in shape of an extra dividend.

The Allen Iron Works at North Adams are quite busy getting out some special orders, among which is a set of the "Allen" grate bars for the largest grate ever made there. It is to fit a fire box 42 × 6½ feet, and is to furnish the furnace of a large electric light plant for parties in Pennsylvania.

At the request of Dr. Robert Amory, I called upon him at his residence, this city. My interlocutor said: "It has been erroneously reported that the Brookline (Mass.) Gas Company, of which I am an officer, had contracted with Mr. Edwards H. Goff, President of the American Electric Manufacturing Company of New York, through his New England agents, Messrs. Sowdon, Elder & Wright, for dynamo machines of 300 arc lights capacity. The facts of the case are as follows: The Suburban Light & Power Company of Brookline, Mass., composed of gentlemen in the management of the Brookline Gas Light Company (but a separate and distinct organization) purchased from Messrs. Sowdon, Elder & Wright two 45 arc light dynamos (American system) and 50 arc lamps; one of these machines being a spare one to keep on hand, but not for immediate use. When the purchase was made it was distinctly understood by the firm named and my company that the Suburban Light & Power Company was not in the least manner obligated to buy more dynamos, lamps, or apparatus from Messrs. Sowdon, Elder & Wright, or from the company they represent, but, to the contrary, reserves the privilege of hereafter purchasing any other electric lighting machines or apparatus. It is the intention of the Suburban Light & Power Company to furnish within its territory only that number of electric lights which may be requested by the authorities or citizens, and under no circumstances will orders be solicited, the officers of my company believing it to be the best policy to occupy an independent stand in the premises, being prepared, however, to furnish at a moment's notice electric lights or gas. We have permission to erect poles and string wires in such districts as have been heretofore supplied by gas by the Brookline Gas Company, excepting the town of Brookline, with the same privileges along the highways between Brookline, Brighton and Allston, and on the streets of the two last-named towns. Two hundred and twenty poles are now being put up, and 450 additional poles have been ordered, and work is progressing rapidly to connect by electric light circuits the districts mentioned with the plant of the Suburban Light & Power Company on Pearl street, Brookline. From the fact of the company's plant being in Brookline, it should not be taken for granted that we intend to light that town with electric lights. No such step is contemplated at the present time."

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Nov. 29, 1886.

It is generally believed here that a syndicate of capitalists comprising the directors of five electric light companies has "cornered" the electric light. Of course, nobody knows anything about the matter, but the *Record* has the following airy talk on the subject:

"A syndicate made up of those gentlemen who want to lease the gas works has obtained control of all the electric lighting companies of this city with one exception, and an increase from 54 cents to $1 per lamp in the average charges for lighting the streets with electricity has been decided upon by the combination, to go into effect at the beginning of next year. The capitalists who have banded themselves together to advance the price of electric lighting in Philadelphia and who expect to obtain control of the gas works of this city by consent of Councils are entirely too modest in their requests. By securing a lease of the gas works their opportunity for saving this city from political mismanagement would still be exceedingly limited. Their control of our streets would only extend to 1,000 miles of wire above the ground, to 200 miles of railway on the ground, and to 823 miles of gas mains under ground. While it is true that the execution of the proposed lease would give to this syndicate the control and direction of the city's expansion for the next twenty-five years by giving the lessees the discretion of saying whether gas mains should or should not be laid to supply new houses, yet this power would sink into insignificance when compared with what they might ask of us if they were disposed to do so. They will probably refrain from asking for any public offices, because they already have control of the machinery by which candidates for office are made and unmade. They already control the supply of oil and electricity for illuminating purposes, and if they can obtain control of the gas supply

they will have a mortgage upon every ray of light that is vouchsafed to us, excepting that which comes from the sun and moon. In addition to the power which this combination wields as a body, one of its members exerts a powerful influence in the regulation of our transportation business; one of them controls all the oil that is retailed in Philadelphia; two of them gracefully regulate the price of pitch and coal-tar for the people of this city, as well as for other parts of the country, and one of them dispenses the political patronage and favors which the voters are supposed to bestow."

The Electrical Department of the city pays from 39 to 62½ cents per lamp for lighting the streets, but the average price, according to Superintendent Walker, is 54 cents per lamp per night. There are 354 public electric lights, and the department will receive bids for lighting the same on Dec. 20, when contracts will be entered into for a period of one year from Jan. 1 next.

It is rumored, as the above shows, that instead of an average price of 54 cents per lamp per night being charged the figures will be raised to $1 per lamp per night. Private lights now cost from 60 to 75 cents per night.

There are five leading electric companies in the city. These are the Brush Electric Light Company, United States Electric Light Company of Pennsylvania, Underground Electric Light and Power Company, Northern Electric Light and Power Company, and the Thomson-Houston Electric Light Company.

The Brush Company has about 800 public and private lights, including 155 lights on Chestnut and other streets which the city pays for. The controlling spirit in this organization is Mr. Thomas Dolan, who is now the acting President on account of the recent death of Mr. Henry Lewis. Mr. Dolan is the head of the syndicate that has presented the offer now before Councils to lease the gas works. Mr. Lewis' name was also attached to the offer when it was first made.

The United States Company controls about 600 public and private lights, including 130 city lamps on Eighth, Arch, Vine and other streets. The stock is largely owned by Messrs. William Warden and William L. Elkins, of the Standard Oil Company, and Mr. P. A. B. Widener.

The Underground Electric Light and Power Company owns the iron sectional conduit which is buried on the south side of Chestnut street. It operates 100 private lights in Chestnut street stores, but does not do any lighting for the city. The controlling interest in this company has lately been acquired by Mr. William Warden, of the Standard Oil and several electric light companies.

The Northern Company has about 200 lamps in all, including 16 street lights, the cost for the lighting of which is paid by the city. Its circuit is confined to the northeastern section of the city and along Second street, Girard avenue and Frankford road.

The agents of the Brush Company obtained a controlling interest in the Northern Electric Light Company some time during the past summer. The Northern Company is an enterprising corporation and possesses the right to light certain streets in the northeastern section of the city.

The Thomson-Houston Company lights twenty-nine street lamps along Columbia avenue, Spring Garden and North Thirteenth streets, and also fourteen in Germantown, and ten in Frankford, which are paid for by the city. The company has about 300 public and private lights on its circuit.

The American Telephone and Telegraph Company, which is at present engaged in laying conduits on Fourth, Walnut and other streets, for the passage of underground cables, has completed the new long-distance telephone line between this city and New York, and telephonic communication is now established between the two cities. The Philadelphia line will not be entirely completed in this city for several weeks.

An Edison Electric Light Company is to be formed in this city with $1,000,000 capital. The chief object of the company is to operate the incandescent system, but preparations are to be made to furnish heat and power also. The intention is to have a series of plants throughout the city, each commanding a section eight blocks square. At first but two plants will be erected, at a cost of $400,000 each. The following are the incorporators: Amos R. Little, B. K. Jamison, Charles M. Swain, S. B. Huey and Henry M. Dechert.

At the last meeting of the Franklin Institute the Committee on Science and the Arts recommended the award of the Elliott Cresson gold medal to Thaddeus S. C. Lowe, of Norristown, Pa., for his improvements in the water-gas process and appliances for the utilization of the same.

The Secretary, Dr. William H. Wahl, reported that the Curators had completed plans for the lighting of the building with incandescent electric lights, and that the work would probably be completed by about the 1st of December.

Students of the subject of Light—electrical and other kinds—will be interested in a paper recently read by Frank E. Ives before the Institute. It gives an account of some recent experiments in photographing with phosphorescent substances. A tablet was coated with a phosphorus paint, exposed in a camera for 30 seconds, and when placed in contact with a sensitized plate in the dark room for about the same period of time, a brilliant negative resulted. Experiments were also made in photographs of the spectrum, it being found that the tablet was affected by the rays below the red or visible end of the spectrum. Mr. Ives concluded that dark objects may be photographed in the camera by the radiation of heat rays from them, and in this deduction he differed from the conclusions of M. Zenger, of Paris, who recently made investigations in the same line, and who held that there were certain "dark actinic rays" to which the phosphorus plates were subject. The subject was discussed by Dr. Wahl, Prof. Houston and others, and a slide of the negative obtained by Mr. Ives was shown.

The *Ledger* says: "The great success of the Electrical Exhibition of 1884, which not only paid for the building in which it was held but left a large profit besides, naturally led to the belief that the Novelties Exhibition which followed, and which had only to refit and repair—not to construct—a building, would at least pay expenses. But such has not proved to be the case. The final accounts show a loss of $7,000 on the 'Novelties;' but, as there was a guarantee fund of three times that amount, the loss falls upon the subscribers to the fund, not upon the Institute. The results of this exhibition are likely to discourage other enterprises of the kind for some time to come. Although there is certainly a real profit coming to some businesses and to the city generally from such undertakings, the men who profit most from them are slow to help sustain them."

Partrick & Carter, the well-known manufacturers and dealers in electrical and telegraph supplies, 114 South Second street, Philadelphia, have issued a neat little revolving calendar for 1887. It requires no tearing off of old sheets, but is adjusted for each month by a simple turn of a disc. It can be hung up anywhere, occupies but little room, and tells the date at a glance.

PENNSYLVANIA NOTES.

York, Pa., Nov. 29, 1886.

The York Electrical Company, with an Edison and American plant, reports business in good shape and increasing. The station is a neat and creditable one. The circuits run three miles. There are 3,000 lamps in use, with a demand to be met for 1,000 more as soon as they can be put in. The plant includes two 800 lighters, four 400 lighters, and two 160 lighters, with one 150 h. p. engine, two 85 h. p., and one 50 h. p., run by three boilers of 100 h. p. each. One more boiler is being put in. There is also one 25 light arc dynamo, but it gives place to a 50 light machine driven by a 50 h. p. engine, built in York at the Agricultural Works of A. B. Farquhar. The 150 h. p. engine was specially built for the station by the Trenton, N. J., Engine Company. The total capital stock is $52,000, paying 12 per cent. The company is a strong one, and has made a good record since it was started in 1885.

WESTERN NOTES.

Branch Office of The Electrical World,
Chicago, Dec. 4, 1886.

As you are aware, the Underground Sectional Conduit Company have what amounts to an exclusive right to lay conduits in this city. Their franchise does not say in so many words that they, and they alone, have the right to put down conduits for the use of electric wires, but as nobody else has so far been able to get wires underground without going into the conduit company's tubes, the impression has naturally become a conviction that the conduit company's franchise is an exclusive one.

On this account there has been considerable chafing among the electric companies, and the dissatisfaction has been the more pronounced from the fact that the conduit company's charges are considered by many to be excessive.

There have been many attempts to get underground independent of the conduit company's ways, but these have always proven failures if there was a conduit reasonably near to the place where it was desired to put down wires.

The latest effort in this direction is embodied in an ordinance introduced in the city council last Monday night. The following from a local daily refers to the matter, and is introduced here mainly for the interesting talk with the Superintendent of Fire Alarms, Prof. Barrett, which it contains:

"The ordinance introduced in the city council on Monday night, asking permission to lay electric wires in the streets and on the housetops after the consent of the owners had been obtained, is another attempt to break into the monopoly enjoyed by the Underground Sectional Conduit Company," said a Republican alderman yesterday. "Mr. Ezra F. Cousins, who asked for the ordinance, is said to be interested in an electric light company. Except the privileges held by the Baltimore & Ohio and Western Union telegraph companies, and the telephone company, this conduit company has the sole right to lay electric wires in the streets of Chicago. The enterprise is not a financial success, and the electric light companies have to pay dearly for the right to put their wires in the conduit company's pipes. Mr. Cousins agrees to pay the city a mileage rental, but he will never get his ordinance. Too many men, situated as Mr. Cousins is, have tried that experiment in vain to give him any hope of laying his wires in the streets without paying tribute to the conduit company."

Prof. Barrett thought Mr. Cousins ought not to be allowed to lay wires in the streets. If he was granted the privilege other persons would want the same rights. He thought some one company ought to be made responsible for the proper care of the electric wires. The conduit company, he said, would lay its mains or pipes wherever any electric light company desired to place its wires. If the applicant was not satisfied with the rental asked, the ordinance of the conduit company provided for an arbitration committee to settle the matter.

"What progress has been made this year toward putting the wires underground?" Prof. Barrett was asked.

"The telegraph and telephone companies have been extending their conduits all summer. The telephone company has 1,500 wires in its conduit beginning at the old board of trade alley and extending to Twenty-second street. All its poles north of that street have been or soon will be taken down. The Western Union wires north of Twelfth street are underground. The city wires above Van Buren have been placed in conduits. During the year 600 poles have been removed, and before spring the number will be increased to 1,000. The wires on the west side to Clinton and north to Erie are nearly all buried. Inside of six months we will have the finest streets, in the business portion of the city, in this country. We have placed about twenty miles of the city's wires underground this year, and will put the remainder beneath the surface as fast as the conduit company constructs its lines. The city pays nothing for the space it occupies in the company's conduits. The company cannot be required to lay conduits without a guarantee of 6 per cent. of the cost. The city would not be willing to undertake the expense, and we will have to wait for the company to extend its pipes."

"To what extent has the fire-alarm system been increased this year?"

"We have put in fifty new boxes and added between sixty and seventy miles of wire. Most of this has been done in the outlying districts where new settlements have sprung up. We now have 531 fire-alarm and 450 police-patrol boxes. We have the largest municipal service in the world. New York has more fire-alarm boxes, but we have more apparatus for public use than that city has. The system is working better than ever before, and we have fewer complaints. No one has come to us this year and raised a rumpus because his building burned down by reason of the fire-alarm system failing to work. Such complaints used to be frequent. This is the only city in America which manufactures all its own apparatus not covered by patents. We make our own switches, lightning arresters, plugs and cables. We do all our own repairing.

"Up to October, the alarms of fire numbered 1,329. The losses were $1,000,000, of which amount the fire at the corner of Wabash avenue and Congress street made up nearly one half."

The Heisler Electric Light Company, of St. Louis, have been for a long time at work developing their incandescent system, and now claim to have brought it to a state of perfection. They are, they say, in a position to undertake the construction of incandescent plants of any size, and claim to be able to transmit the current an unusually long distance. They guarantee seven 30-candle lights to the horse-power, and do away with distributing boxes, transformers, converters and shunt boxes. They especially call the attention of arc-light companies, gas companies and city authorities to their system, and claim that with their apparatus the incandescent light is a successful competitor of gas. In St. Louis they have 1000 30-candle lights on 20 miles of line-wire circuit, at Leavenworth, Kansas, 150 30-candle lights on a five-mile circuit, and at Vincennes, Ind., they have 150 30-candle lights on a fifteen-mile circuit for street lighting, and 150 30-candle commercial lights, the power being furnished by a 42 h. p. engine with a fuel consumption of only one dollar per night.

Munson & Company, of Chicago, have just furnished the belting for the Thomson-Houston station, at Aurora, Ill.

West Indianapolis, Indiana, is still making additions to its street lighting. The Jenney Electric Company have just completed a 70-foot tower, which supports a 2,000 candle-power lamp.

Several applications have been made to the Indianapolis City Council by individuals for permission to build telephone lines to connect with the Central Union lines. These have been granted in Council, but refused by the Board of Aldermen. It will be remembered that the right to build lines was taken from the telephone company during the agitation in connection with the $3 a month law.

I make the following extract from a card published by the Secretary of the Citizens' Co-operative Telephone Company (Wallace) of Indianapolis: "The Citizens' Co-operative Telephone Company, of Indianapolis, started in in good faith and sincerity to give our citizens a cheap, efficient and uniform telephone service. The city authorities have granted us a reasonable franchise, and no other in existence, under which we have operated so far as we can go until the way is cleared for us. We have poles and other material on the ground, the Board of Trade building for an exchange, and funds in bank, and in all respects prepared to proceed vigorously with the construction of our plant. The committee of the Council having the matter in charge are well advised of the situation. We have acted on their suggestion, put in pay line under great disadvantages, that we might commit the overt act as a basis of injunction threatened by those who are only tenants at will. They have not done so, are simply standing still, threatening us with the law, at the same time violating both the letter and spirit of the telephone law of the State, saying they will not obey it, and, by threats and intimidations, preventing others from giving the people what they want."

Col. S. G. Lynch, of 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$159@$161
Central Union	49@ 50
Chicago	375@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	33@ 36
Iowa Union	16@ 19
Michigan	73@ 75
Rocky Mountain Bell	40@ 45
United	17@ 19
Wisconsin	104@ 106

W. A. K.

THE TELEGRAPH.

T. M. B. A.—Assessment No. 202 for $1, now due, is made to meet the death claim of Mr. John Dunn, of Shortsville, N. Y.

Cable Broken.—The Government cable between the islands at Martha's Vineyard and Nausbon gave out last week. A steam collier is supposed to have fouled it with her anchor.

District Messenger Service.—The New York *Star* makes editorial complaint about the inefficiency of the local messenger service, and "proposes to open a lively warfare on some of these messenger companies if they do not reform their ways."

The Cable Convention.—The only reference in the President's message to electrical matters concerns the International Convention to secure safety of ocean cables in time of war. It goes into effect January 1, but needs United States legislation. A passing word is said in favor of cable communication with the Sandwich Islands.

Tickers Thrown Out.—A dispatch from Chicago of Dec. 4 says: "The Western Union Telegraph Company have for years been furnishing the Chicago Board of Trade with market reports from the commercial centres and ticker service on the floor for the use of members, making an exorbitant charge therefor. The Board recently made a contract with the Commercial Telegram Company, of New York and Chicago, for this service. To-day the Western Union tickers were removed from the floor and the Commercial tickers substituted." The bucket shops are again to be attacked.

Telegraph Business in Dakota.—The Dakota board of railway commissioners have just received from the Western Union Telegraph Company a report of its business in Dakota the past year showing: Miles of wire in the territory, 4,318.97; number of offices, 212. Their total figures show miles of wire, 482,184: number of offices, 15,139; earnings of year, $16,778,670; expense, $12,672,180. The board will recommend to the legislature a tax upon the gross earnings of all telegraph, telephone, and express companies in the territory, the same as now in case of railroads. The companies are strongly opposed to this.

An "Honest" Boy.—Mrs. Augusta Smith, of No. 1,129 Broadway, sent to the Baltimore & Ohio Telegraph office, at 1,140 Broadway, a few days ago for an honest messenger boy, stating that she wanted to send him downtown with $200 to her lawyers, Rabe & Keller, No. 243 Broadway. The manager of the

office sent James H. Young, the sergeant, who was considered honest and trustworthy. Mrs. Smith gave Young the money, but he failed to go to the lawyers' office. When the boy did not come back Mrs. Smith went to the office and it was discovered that Young had run away. The police have caught him.

A New Pacific Cable.—A dispatch from San Francisco, of Nov. 29, says: "Advices from New Zealand state that a company has been organized to construct a Pacific cable, to cost $10,000,000, as follows: From Brisbane, or some part of New South Wales, to North Cape, New Zealand, 1,300 knots; to the Fiji Islands, 1,240 knots; to Fanning Island, 2,270 knots; to the Sandwich Islands, 1,260 knots; to Vancouver Island, 2,730 knots; across the island and straits of Georgia to Vancouver City on the main land, the terminus of the Canadian Pacific railway, 100 knots. An annual subsidy of $500,000 is expected to be obtained from the colonial and imperial government, jointly."

An Elopement.—The blue grass region in the vicinity of Paris, Ky., has been greatly exercised over the sensational elopement of Miss Alma Thomas, one of the handsomest women in that region, and Mr. Albert C. Adair, a young telegraph operator of the same town. Early on the morning of Nov. 24 Miss Thomas stole silently from the house and leaped into a buggy, which her lover drove at a wild speed to Cynthiana, thirty miles distant, arriving at 7 A. M. A train bound for Cincinnati was boarded, and at 1 P. M. the couple was wedded in the Gibson House parlor. The remarkable feature of the case is that Miss Thomas was to have been married on the 28th to Mr. Jep Lail, a rising young business man, of Paris, and had already procured the trousseau for the event. Her father is one of the wealthiest tobacco planters in Kentucky. It is doubted whether her parents will excuse her conduct.

THE TELEPHONE.

Syracuse, N. Y.—There appears to be trouble brewing at Syracuse, consequent on the change in the management of the telephone exchange, which passes into the hands of the Central New York Company.

The Lowell Syndicate Suit.—The arbitration in the suit of W. H. Bent and others against the Erie Telephone Company, to recover salary for services rendered, has, after several hearings in which the liveliest interest has been taken in Lowell, been decided in favor of the company.

The Government Suit.—A Washington evening paper says: "Solicitor-General Jenks, ex-Solicitor Goode, and the Hon. Jeff Chandler, of counsel for the Government, have left Washington for Columbus, Ohio, to confer with ex-Senator Thurman, also one of the Government counsel, as to the next legal steps to be taken with regard to the Bell Telephone case. It appears that the counsel are divided on the question whether to appeal the case to the United States Supreme Court or commence a new action in the courts of Massachusetts. The conference of counsel will determine the next steps to be taken."

Rochester, N. Y.—Reports from Rochester, of Dec. 4, say: It is definitely announced that a stock company will be formed in this city to push the interests of the Dann and Lapp make-and-break telephone, and that exchanges will be soon established in Rochester and Buffalo. Last night a secret conference was held between a committee of the Subscribers' Association, and a delegation from Buffalo representing the Bell Company. The session was a protracted one, lasting until 1 o'clock this morning. The Bell men protested that the proposed rates were necessary to a profit, and finally suggested that the subscribers name some flat rate. Not one could be agreed upon, and the meeting adjourned.

THE ELECTRIC LIGHT.

Cleveland, O.—The Post-Office and Custom House building is about to be lighted by electricity.

Pittsburgh.—The East End (Westinghouse) Company is installing another thousand lights.

Canton, O.—The Canton Schuyler Company, incorporated by J. H. McLain and others, has a capital stock of $50,000.

The Clark Electric Company has been incorporated under the New York State Laws with a capital stock of $3,000,000.

The Bridgeport Electric Company, Bridgeport, Conn., have started up their new Armington & Sims Co. engine recently received.

Carbondale, Pa.—The American Company were given an order last week for a 50-light plant which is to be installed immediately.

Marion, Va.—Westinghouse, Church, Kerr & Co. have the contract to put a 600 incandescent plant in the Virginia State Insane Asylum at Marion.

Torrington, Conn.—The Westinghouse plant to be run by water power will include 500 incandescent lamps. The streets will also be lighted by it.

West Troy, N. Y.—The West Troy and Green Island Electric Light Company has been organized by T. Knowlson and others, with a capital stock of $50,000.

Belvidere, N. J.—The Belvidere Gas and Electric Light Company has been incorporated by E. M. Beesley and others, with a capital stock of $30,000.

Appleton, Wis.—The Electric Light and Power Company, of this city, has closed a contract with the American Electric Manufacturing Company, for dynamos and lamps, with capacity for seventy-five lights.

New Jersey.—The Essex County Light, Heat and Power Company, East Orange, N. J., has been formed with a capital stock of $50,000, the incorporators being H. H. Westinghouse, W. C. Kerr and W. Lee Church.

Philadelphia.—The American Electric Manufacturing Company has sold a 50-light plant to the large worsted mill of Messrs. S. Schofield Son & Co., in East Manayunk. It is to be installed and in running order the early part of next week.

Sanford, Me.—A dispatch from Sanford, Me., of Nov. 30 says: The principal business houses are illuminated by electric light to-night, and the streets are to be so lighted shortly. The plant is owned and controlled by J. B. Clark. Chapman dynamos are used exclusively.

Boston, Mass.—The Merchants' Electric Light Company, Boston, have received their new 125 h. p. Armington & Sims engine. It is not decided how the power of this engine will be utilized. It was the original intention to use it for transmitting electric power, but owing to the increased demand for electric lights it may be used for the latter purpose.

The American System Abroad.—The American Electric Manufacturing Company last week completed arrangements with the well-known electrical firm of Wockatz & Company, of Gothenburg, Sweden, to become wholesale agents for the American Company in Norway and Sweden. The concern has done a very large and prosperous business for the Edison Company, and it is expected that they will sell a large amount of arc light apparatus.

Gas and Electric Light Combination.—The combination between the American Company and gas companies is said to be working agreeably to the wishes of the officers of the former corporation. It is said that an important improvement which the American Company have been negotiating for during some months, has been secured, and that the company is to devote $500,000 additional capital to the increase of its manufacturing facilities.

An Important Purchase.—The Westinghouse Electric Company have purchased the entire property lately occupied by the Union Switch & Signal Company, and are installing a large plant of new tools. The testing room is one of the largest in the business. Power for it is furnished by two Westinghouse engines of 200 horse-power each, so coupled that a large number of dynamos may be tested at once and for a long run. The Switch and Signal Company have purchased property at Swissvale, and are erecting new works, together with cottages for employés.

Woonsocket, R. I.—The Woonsocket Electric Light Company has received its new Armington & Sims Company engine, to be used for incandescent lights. This style of engine is so arranged that while one fly wheel is used for running an arc light dynamo, the other, of a larger diameter, can be used to run incandescent lamps. In some electric light stations the Jarvis Engineering Company, who sell these engines, has arranged them so that while one wheel is used for electric lighting, the other is used for running a line of shafting in the loft above to run machinery.

Once More Niagara.—The Buffalo *Courier* has the following relative to the Westinghouse transformer system: "It is learned that a company to operate under this system is to be formed in this city, and several of the men interested were among the observers of the successful test. Among those who have investigated the new system with this view in mind are John F. Moulton, James Adams, William S. Frear, Daniel O'Day, Wilson S. Bissell, Charles W. Goodyear and others. There is talk of establishing a plant at Black Rock, where ample water power can be obtained, and it is within the range of possibility that a station may be erected at Niagara Falls for the purpose of supplying the whole of Western New York with the incandescent system."

Hornellsville, N. Y.—The electric light plant of the American system installed in the above place about a year ago has given the most perfect satisfaction to the Hornellsville Company, and there has been a constant increase of business since the plant was first established. The company is now paying 1 per cent. monthly dividends, a rate highly satisfactory to its stockholders. Owing to the increased demands for lights and the fact that the Erie Railway Company have given it a large order for lights in their railway works, the company has decided to make a large increase in its plant. Last week an order was given to the American Company for one hundred additional lights. This will make the American Illuminating Company of Hornellsville one of the largest plants in the State, outside of the big cities.

Portland, Me.—The Consolidated Electric Light Company, of Maine, a majority interest in which is owned by the American Electric Manufacturing Company, is making some very large additions to its present plant. The company now lights the entire city of Portland. Three hundred arc lights are in use and about four hundred Edison incandescent municipal lamps. The company's present building having become inadequate to the increased demand, a new building, sixty by one hundred feet, is being built and will be completed within sixty days. It will be one of the finest blocks in Portland. New boilers and engines are now being installed. The arc and incandescent systems are both to be largely increased. Besides lighting, the company is going to put in a large installation of electric motors for the transmission of power. It is even said that about five hundred horse-power will be installed this winter.

Domestic Lighting in Philadelphia.—Domestic lighting by electricity has only very recently been introduced into Philadelphia. The Keystone Light and Power Company have within a few weeks established a central supply station on Sansom street, above Seventh, and are now engaged in supplying incandescent lamps in several newspaper offices and stores in the vicinity. They are also extending their system so as to include the district bounded by Market and Walnut, Sixth and Ninth streets. This is said to be the first attempt at central station lighting in Philadelphia by incandescent lights exclusively, although several separate plants are used to supply special buildings. The *Record* and *Ledger* buildings each have separate plants, and the Drexel banking-house is supplied by a special cable from the plant of the *Ledger*. The system employed is that of the Westinghouse Company.

APPLICATIONS OF POWER.

Pensacola, Fla., is to have its street cars run by electricity.

Sprague Motors in Demand.—The Sprague Company reports great difficulty in keeping pace with the demand for motors.

The Van Depoele Electric Roads.—There are now in daily operation at Montgomery, Ala.; Appleton, Wis.; Detroit, Mich.; Port Huron, Mich.; Scranton, Pa., and Windsor, Ont. thirty miles of track on the Van Depoele system with twenty-eight cars.

The Port Huron, Mich., Street Railway.—The Port Huron, Mich., Electric Railway Company, operating on the Van Depoele system, has about four miles of track. It runs one train of three cars drawn by a 15 h. p. motor, and has two independent cars with motors of 10 h. p. each, capable of pulling another car. One overhead wire is used, the track serving for return circuit. The road has now been running since September 1, and has given so much satisfaction that it is intended to extend it to Huronia Beach. One new feature in this road is that the cars cross a turning or swing bridge over the river. The bridge is about 200 feet in length, and the overhead wire is so arranged as not to break circuit when the bridge is open for vessels to pass through. As the bridge closes an automatic device immediately makes connection. This plant was put in by the Van Depoele Construction Company, of Detroit, Mr. W. K. Muir president, which also built the Dix road, and has others under contract.

PERSONALS.

Mr. George Westinghouse, we are informed, has just purchased a piece of ground at the corner of Penn avenue and Ninth street, Pittsburgh, on which to erect an imposing office building. The property is 80 × 100. The price paid was $78,000. The new building will cost at least $200,000. It will be a magnificent structure, eight stories in height. Pressed brick with terra-cotta finish is the material to be used. The building will contain all the offices of the Philadelphia Gas Company and all Mr. Westinghouse's other offices, including the Westinghouse Air Brake Company, the Union Switch and Signal Company, the Westinghouse Machine Company, the Westinghouse Electric Light Company offices; Westinghouse, Church, Kerr & Co., and the Safety Appliance Company. The edifice will be known as the "Westinghouse Building," and it is expected to be ready for occupation next July.

MISCELLANEOUS NOTES.

An Attractive Calendar.—The National Carbon Company, of Cleveland, O., has issued a remarkably artistic calendar, steel engraved, on heavy, tinted cardboard. The principal feature in the calendar is the Garfield Monument at Cleveland.

Fallible Records.—Probably few persons, says an exchange, realize how unreliable are the unprofessional thermometric reports which are telegraphed in winter over the country after each cold wave, so untrustworthy are even the best of spirit thermometers in unskilled hands. Dr. John Rae expresses the opinion that the thermometer which is quoted as having recorded 58 degrees below zero in Manitoba is about 15 degrees in error. An instrument for the accurate measurement of low temperatures is needed as much as a reliable pyrometer for testing the temperature of molten metals.

Curious Lightning.—Recently a peculiar accident occurred at Ryde, Isle of Wight, during a thunder-storm. The telegraph wires between the railway terminus and the pier head were struck, rendering them utterly useless. Two officials who were standing near had narrow escapes. The lightning was conducted to two small batteries at the end of the pier, whence it flashed out striking a small leaden pipe with such force as to penetrate it, lighting the gas. Then it returned to the earth, leaving a mark where it struck, close to the spot where a collector and a lad were standing.

Gilding by Deposition.—A process for gilding or decorating glass with gold and silver has been brought out by the Glass Decoration Company. It is stated to be a revival of an older process, or in other words, the discovery of a lost art. The metal is precipitated on the back of the glass, and then coated with a protective composition which excludes the atmosphere. Some time ago it was found that platinum and other metals could be fixed on the back of glass by the electric discharge. But this discovery has not been so much heard of as might have been supposed. The method by precipitation deprives ordinary gilding of a serious drawback, namely, its destruction by the atmosphere.

The Egan Company.—A new electrical concern has been incorporated to do business in Columbus, O. It is the Egan Electrical Manufacturing Company, with a capital of $25,000. The object of the corporation is to make, sell and deal in electric, magneto and mechanical telephones, electric motors, electric lights, electrical and mechanical instruments, devices, appliances and supplies, and all apparatus pertaining thereto. The company is also empowered to purchase, or otherwise acquire, patents pertaining to electrical appliances, and to sell or lease the same, and to do all other business pertaining to the objects set out in the articles of incorporation. The incorporators are Ralph Bulkley, J. I. Doyle, C. A. Warner, Henry L. Peck and C. S. Morgan.

Hydrogenated Palladium.—According to Professor C. G. Knott, in a paper recently read before the Royal Society of Edinburgh if a wire of palladium be dipped into an electrolytic cell so as to become hydrogenated throughout half its length, and the ends of the wire be connected to the terminals of a galvanometer, a current will be obtained in the latter when a flame is allowed to play upon the middle of the wire at the limit of the hydrogenated and non-hydrogenated palladium. This current is due to the thermo-electric effect between the two portions of the wire. The current rises to a maximum, then diminishes to zero as the temperature of the junction is further increased to a red heat. There is no such current during the cooling of the wire.

Anything to Beat Wiggins.—Mr. Foster, the meteorologist, of Burlington, Ia., publishes a prediction of a great storm period, extending from Dec. 4 to 17, during which will occur some of the most destructive winter storms of recent years. These storms will be much of the same nature as the great blizzards of last January. Heavy snow and high winds will greatly impede railway travel, and he advises the railways to prepare for blockades that will occur in the Western States about Dec. 5, and reach the Eastern States Dec. 9. These storms will break up the drought in the Southeastern States. There will be energetic electrical disturbances that will affect telegraph and telephone lines. He suggests that many lives and much property can be saved from loss by making preparations for the severe weather of this storm period.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

December 6, 1886.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	40
Am. Tel. & Cable	77	78
Cen. & So. Am.	75	100
*Com. Tel.	103	.....
*Gold & Stock	92⅛	97⅛
*Inter. Ocean Tel.	92	97
N. Y. Mutual	72	.....
Pac. & Atl.	45	55
*Postal T. & C.	20	25
South. & Atl.	65	75
W. U. Tel.	77¾	77⅞
W. U. Scrip.	71	.....
W. U. Bonds	.....	123
Mut. U. Bonds	86	86½
TELEPHONE.		
Am. Bell	205	206
Am. Speaking	110	125
Erie	29¼	29¾
*Hudson River	45	55

TELEPHONE.	Bid.	Asked.
Mexican	1⅜	1½
*N. Y. & N. J.	85	90
N. Y. & Pa.	.....	.....
New England	43¼	43¾
*Southern Bell	110	130
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	78	.....
*Brush Ill	90	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	130	.....
*Edison Ill	85	100
*Edison Isolated	.....	110
*United States	.....	.....
*U. S. Ill	91	100
MOTOR.		
*Daft	.....	.....
*Sprague	600	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

SPARKS AND FLASHES.

Wonders of the Telephone.—The Principal (from the city through the telephone, to the foreman at the "works")—"How do you get on, Pat?" Irish Foreman (in great awe of the instrument)—"Very well, sir; the goods are sent off." The Principal (knowing Pat's failing)—"What have you got to drink there?" Pat (startled)—"Och! Look at that now! It's me breath that done it!"—*Punch*.

A Nice Man.—"Of course there would naturally be more or less complaint about telephones," said Superintendent Jackson, but we have one subscriber in Detroit who has never kicked, and he has had a telephone for seven years."

"Who on earth can it be?"

"My assistant!" was the calm reply.—*Detroit Free Press.*

A Rather Tricksy Fellow.—Contracts made over the telephone are to be held binding and are to be enforced. That's what the Missouri Court of Appeals says. It means of course that they are binding if they can be proved. But that's where the trouble would come in. Who at one end of the wire can make sure of who is at the other, or be certain about what he says? "Hello" is a rather tricksy fellow—now you have him and now you don't.—*Philadelphia Inquirer*.

The Hotel Telephone.—Gentleman (to telephone clerk).—Tell Mrs. Brown, 101 Blank street, that Mr. Brown came home last night, and ask her to send down the carriage.

The telephone clerk—Hello, Central. (Pause.) Hello! (Pause.) Hi, there, Central. Hello, hello! 101 Blank street—no, no, not Crank street. One hundred and one. Yes. No, I'm not done—*one*, I say. All right. Mrs. Brown? Grand Colossus. Grand Colossus. Colossus, Colossus, *Colossus!* Got it? Mr. Brown says he came home last night, and wishes you to send down the carriage. No, I didn't say marriage—carriage. Send down the carriage. Here, of course. Why, to the Grand Colossus—Colossus, Colossus! Brown sends it—Brown! No; not out of town—Brown, not town. Yes. No. Yes. Yes. Yes. Good-day. Twenty-five cents, sir. [Hangs up receiver and falls exhausted—as well he may.]

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

Anti-Magnetic Shields.—Messrs. Giles Bros. & Co., Chicago, Ill.: Gentlemen: Your Anti-Magnetic Shield for Watches cannot be overestimated. It is now very near eight months that I have worn my watch, and to-day it is, without ever correcting time, about one minute slow. Considering the fact that I am every day near Dynamo-Electric Machines in our regular business, the test could not be harder. I could never have believed that the protection was so complete.

In this age of electricity, not only electricians, but every one who needs correct time, should have the Anti-Magnetic Shield. A good deal of practical utility, as well as pleasure, can be derived from a good time-keeper. At present I look upon a watch without a shield as a thing incomplete; and so it is.

Very respectfully, CHAS. J. VAN DEPOELE,
Electrician V. D. P. E. M. Co.

Address GILES BRO. & CO., for particulars, price, etc.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED NOV. 23, 1886.

352,647. Automatic Electric Liquid Level Indicator; John J. Ghegan, Newark, N. J. Application filed May 29, 1886. A selenium cell in circuit with alarm apparatus is placed near a glass tube connected with a boiler on the opposite side from a lamp or other source of light. Ordinarily a float in the tube shuts off the light from the cell, but when the water falls too low the float drops far enough to expose the cell to the light, whereupon an alarm is sounded. [The above patent is dated Nov. 16, 1886.]

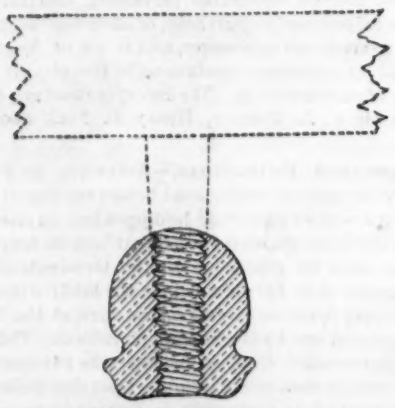
353,274. ELECTRIC BELL.

352,948. Individual Call Apparatus; Lycurgus S. Glover, Marion, Kansas. Application filed March 1, 1886. The invention covers various details, and has the usual functions of individual call apparatus.

352,990. Automatic Electric Signal Coupler; John S. Copers, New Orleans, La. Application filed Feb. 11, 1886. The coupler is especially adapted to use in the circuit of a railway train. The breaking apart of the coupling, as by the separation of a train, closes the circuit and sounds an alarm on the engine.

353,003. Electric Motor for Sewing Machines; Ernest Recordon, Paris, France. Application filed June 23, 1886. Operates the needle, shuttle and feed-bar of a sewing machine. Comprises also special constructions, combinations and arrangement of parts.

353,035. Mode of Connecting and Disconnecting Generators for Electric Lighting; John W. Howell, New Brunswick, Assignor to himself and Francis R. Upton,



353,120. INSULATOR.

Orange, N. J. Application filed June 5, 1886. The invention relates to a system in which a number of electro-magnetic generators are driven from the same line-shaft, and each has a loose pulley on the shaft and a clutch for connecting the pulley to the shaft when it is desired to start the generator, so that the shaft may not be stopped. The invention consists mainly in converting the generator into a motor supplied with current from the other machine, first, when it is desired to start a machine, so that the motor drives its loose pulley and brings it up to the speed of the shaft; and, second, when it is desired to stop a machine, so that the strain is taken off the pulley.

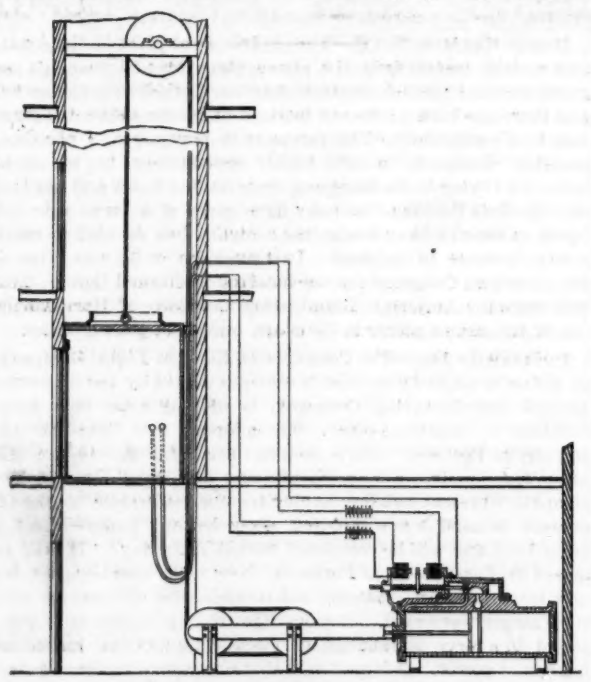
353,120. Insulator; Robert G. Brown, Brooklyn. Assignor to E. S. Greeley and Co., New York, N. Y. Application filed June 24, 1886. The insulator is especially adapted for use upon the under side of a cross arm or support. It has a central longitudinal opening extending entirely through it and threaded throughout its extent. See illustration.

353,123. Electric Elevator; John H. Clark, Boston, Mass. Application filed Aug. 12, 1886. The operation of the power-valve is controlled by electrical switches located on the car. No shipper rope passes through the car, nor about sheaves located outside the car. See illustration.

353,128. Multiple Telegraphy; Stephen D. Field, Yonkers, N. Y. Application filed July 31, 1886. For description see ELECTRICAL WORLD for November 27, 1886.

353,141. Electric Battery; James A. Kendall, Middlesborough, County of York, England. Application filed Jan. 18, 1886. For description, see page 286 this issue.

353,142. Application of Secondary Batteries to Electric Lighting; Edward R. Knowles, Brooklyn, N. Y. Application filed May 18, 1882. Renewed October 28, 1886. The object of the invention is to provide a convenient, economical and automatic means for alternately charging and discharging two sets of storage batteries included in circuit with a generator and translating devices, for the purpose of continuously operating the latter. An electric generator and electric lamps are shown, together with two intermediate secondary batteries, a commutator for throwing the batteries alternately into connection with the generator and the lamps and automatic means for working the commutator. See illustration.



353,123. ELECTRIC ELEVATOR.

353,151. Dynamo Electric Machine; Richard H. Mather, Windsor, Conn. Application filed Jan. 2, 1886. For description, see page 283 this issue.

353,158. Incandescent Electric Lamp; Albert L. Reinmann, Pittsburgh, Pa. Application filed Aug. 12, 1886. The object of the invention is to provide means for cementing the filaments in place without liability of breaking or bending them, and without disturbing their electrical resistance.

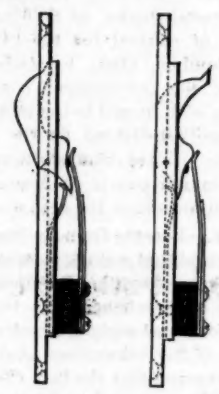
353,164. Brush-Holder for Dynamo Electric Machines; Albert Schmid, Pittsburgh, Pa. Application filed July 29, 1886. The invention provides large contact surface between the brush clamps and their supporting bars, and also provides for a great range and capability of adjustment of the parts forming the holder.

(1.) 353,179. Regulator for Electric Currents; (2.) 353,180. Regulator for Dynamo Electric Machines, Motors, etc. Elihu Thomson, Lynn, Mass. Applications filed June 10, 1886. 1. One of the main features of this invention is an adjustable rheostat consisting of an electric conductor whose conductivity varies with changes of temperature, combined with means independent of the current to be adjusted for varying the temperature of the conductor, so as to vary its specific resistance with a given current. 2. For description, see page 280 this issue.

353,184. Electric Switch-Board; Joseph H. Wehrle, Newark, N. J. Application filed November 30, 1885. Means are provided whereby the same movement on the part of a switch-board operator breaks the ground circuit and completes the line circuit, thus dispensing with one manipulation.

353,248. Electric Lighting of Railway Trains; Charles E. Buell, New Haven, Conn. Application filed Aug. 4, 1882. Each car is equipped with electric conductors extending through the car and forming part of a main charging circuit, a series of storage batteries, a working circuit, including electric lamps, and switch devices for withdrawing in turn each battery of the series entirely from the working circuit, and interposing it in the charging circuit, and simultaneously closing the working circuit with the other batteries of the series coupled for intensity.

353,263. Electric Door-Opener; Adam Lungen, New York, N. Y. Application filed Jan. 26, 1886. A nosing or striking plate pivoted to the door frame in the path of the door

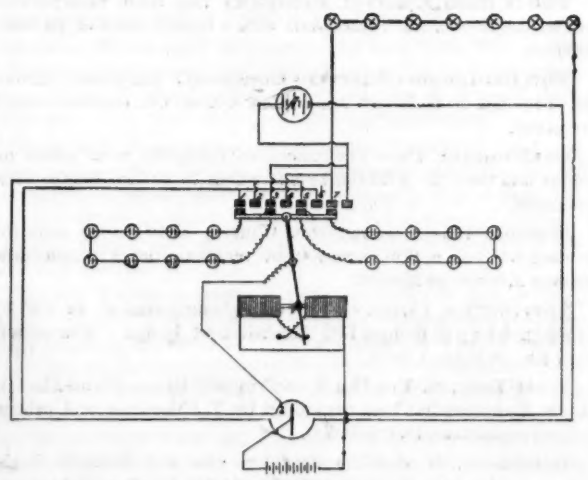


353,269. WINDOW SPRING FOR ELECTRIC BURGLAR ALARMS.

bolt or latch can be released by electro magnetic action, and the door be left free to swing open.

353,269. Window Spring for Electric Burglar Alarms; Theodore H. Parker and John Geary, Philadelphia, Pa., Assignors to Shaw & Geary, same place. Application filed July 12, 1886. The object is to prevent window spring circuit controllers from becoming "set." For the construction, see illustrations.

353,273. Striker for Electric Bells; Charles A. Tucker, Islip, and William Henry Markland, Brooklyn, N. Y., Assignor, by mesne assignments, to said Charles A. Tucker. Application filed Jan. 8, 1886. The striker spring is provided with a collar, by turning which the armature and bell hammer connected



353,142. APPLICATION OF SECONDARY BATTERIES TO ELECTRIC LIGHTING.

with the spring can be adjusted to any desired degree of proximity to the magnet poles without bending the spring.

353,274. Electric Bell; Charles A. Tucker, Islip, and Otto H. Huebel, Brooklyn, N. Y., Assignors, by mesne assignments to said Charles A. Tucker. Application filed May 2, 1886. The object is to secure the parts against injury from dust, moisture, or insects, and to make it easy to adjust or take out and replace the parts without removing the case from its support. See illustration.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.